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ABSTRACT

This document contains volume 1 of a four-volume report which describes the components of the Health Services Mobility Study (HSMS) method of task analysis, job ladder design, and curriculum development. Divided into three chapters, volume 1 is intended as an introduction to the method and contains the basic task analysis instruments. Chapter 1 provides an overview of the HSMS system and the basic concepts. Chapter 2 contains the HSMS definition of task, the HSMS scales (including the scale for task frequency, sixteen skill scales, and the knowledge scale), and the basic data collection forms. Chapter 3 contains the HSMS knowledge classification system. This document and the related volume (see note) are designed to assist institutions in rationally structuring work, utilizing its labor force, evaluating its work performance, developing job ladders, designing job-related education, or creating work-related test instruments. (BM)

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THE HEALTH SERVICES MOBILITY STUDY METHOD OF TASK ANALYSIS AND CURRICULUM DESIGN

Research Report No. 11

Volume 1

BASIC TOOLS: CONCEPTS, TASK IDENTIFICATION, SKILL SCALES AND KNOWLEDGE SYSTEM

by
Eleanor Gilpatrick, Director
Health Services Mobility Study

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The major funding for HSMS has come from the Manpower Administration, now the Employment and Training Administration of the U.S. Department of Labor (Contract No. 82-34-69-34). Our special thanks go to William Throckmorton, our Project Officer, who has cared for the project and nurtured it, to Seymour Brandwein, a former Director of the Office of Research and Development of the Manpower Administration, who saw the potential of the work when it was in its early stages, and to Dr. Howard Rosen, current Director of the Office of Research and Development, who has had the faith to permit us to continue the work to its completion.

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HSMS is sponsored by the Hunter College School of Health Sciences, where the author is an associate professor, and the Research Foundation of the City University of New York. The support and encouragement given the project by Gerald Graze, Executive Director of the Research Foundation, has been an enormous help; Dr. Michael R. McGarvey, Vice President for Health Affairs at Hunter College, has provided the attention, support, and faith in the project's work which has made it possible for it to be completed.

Major thanks go to some outstanding HSMS staff members. Christina Gullion was responsible for the major theoretical work in curriculum development and proficiency testing and reviewed most of the scaling data. She has been my right hand and my colleague. Irene Seifer was deeply involved in the development of the skill scales, trained the HSMS job analysts, reviewed most of the scaling, was a senior job analyst, and has edited much of the work. Jeanne Bertelle was a memorable and thorough senior job analyst, who also scaled and reviewed the scaling for most of the tasks. Many other staff members have been involved in the work and have been acknowledged in the earlier documents.

Our chief consultant for methodology was Dr. Earl E. Davis, who brought his training in social psychology and research design to the project and contributed greatly to its technical quality.

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Eleanor Gilpatrick, Director

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PREFACE

In September of 1967, the author became the director of the Health Services Mobility Study, a project funded by the Office of Economic Opportunity. The grant carried the charge that the project investigate the impediments to upward occupational mobility in New York City Municipal Hospitals and that it suggest means of overcoming obstacles to such mobility. It was a one-year grant.

Ten years later, the Health Services Mobility Study (HSMS) is ending its research and development activities. During that time, HSMS examined the occupational structure of New York City Municipal Hospitals and investigated the problems of skill shortages and credentialing.[1] It then undertook to design a method to promote occupational mobility by tying job requirements to curriculum design in a single system.

HSMS has developed, field tested, and applied a method to analyze work (task analysis) and design job ladders. It moved on to develop a method for curriculum design using task data and for the design of educational ladders to parallel job ladders. It eventually expanded the method to show how to make job structures and curricula responsive to quality standards and the needs of consumers, and to show how occupational mobility can be economically attractive to employers. It then completed the system by showing how task data and curriculum objectives produced by the method can be used as inputs to the development of performance evaluation instruments and for the selection of content for, and validation of, occupational proficiency tests.

HSMS has made theoretical contributions to the fields of job analysis, curriculum development, and occupational testing. It has helped to promote the concepts of upward occupational and educational mobility, and has developed a design for a safe practice, quality assurance program in diagnostic radiology.

The HSMS method was pilot-tested in an ambulatory care community health center. It was given a full-scale application in diagnostic radiology. An abbreviated version of the method was applied to the technologist, technician and aide functions in radiation therapy and diagnostic ultrasound. A curriculum has been developed including the aide, technician and technologist levels in diagnostic radiology.

Although these applications have been in health services occupations, all of the components of the method are generic and can be applied to any work activity in any industry.

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[1] Eleanor Gilpatrick and Paul Corliss, The Occupational Structure of New York City Municipal Hospitals, New York: Health Services Mobility Study and/or Praeger Publishers (Research Report No. 2), 1970.

Now the time has come to share the method so that it can be used by others. This research report offers all the components of the HSMS method of task analysis, job ladder design, and curriculum development for use as a system or in part. It is offered to any institution that wishes to expend time and resources to rationally structure work, utilize its labor force, evaluate its work performance, develop job ladders, design job-related education, or create work-related test instruments. This material is reported as follows:

Research Rpt. No. 11	THE HEALTH SERVICES MOBILITY STUDY METHOD OF TASK ANALYSIS AND CURRICULUM DESIGN.
Vol. 1	Basic Tools: The Concepts, Task Identification, Skill Scales and Knowledge System.
Vol. 2	Writing Task Descriptions and Scaling Tasks for Skills and Knowledge: A Manual. (Also contains an abbreviated version of the task description method.)
Vol. 3	Using the Computer to Develop Job Ladders. (Includes technical material, computer programs, and scholarly review.)
Vol. 4	Developing Curriculum Objectives from Task Data: A Manual.

The reader is directed to other HSMS documents for additional information not contained in Research Report No. 11 as follows:

Technical Rpt. No. 11	HEALTH SERVICES MOBILITY STUDY: FINAL REPORT FOR THE PERIOD OCTOBER 1967 THROUGH MARCH 1972. (Contains a review of the literature in task analysis and the derivation of the HSMS task analysis method.)
Working Paper No. 11	THE DESIGN OF CURRICULUM GUIDELINES FOR EDUCATIONAL LADDERS USING TASK DATA. (Earlier version of HSMS curriculum design method. Contains a review of the literature in occupational curriculum design and behavioral objectives, and other related material.)

Research Rpt. No. 7	TASK DESCRIPTIONS IN DIAGNOSTIC RADIOLOGY.
Vol. 1	Medical Tasks: What the Radiologist Does.
Vol. 2	Radiologic Technologist Tasks Dealing With Patient Procedures.
Vol. 3	Machine-Related, Patient Care and Administrative Tasks: What Radiologists, Technologists, Nurses, and Physicists Do To Run Things and Look After Patients and Equipment.
Vol. 4	Index of Tasks by Code Number and Extended Name.
Research Rpt. No. 9	THE TECHNOLOGIST FUNCTION IN FIELDS RELATED TO RADIOLOGY: TASKS IN RADIATION THERAPY AND DIAGNOSTIC ULTRASOUND.
	(Research Reports Nos. 7 and 9 contain HSMS task descriptions and task summaries which can be used as models for writing task descriptions or used directly when there are task overlaps.)
Research Rpt. No. 8	USING TASK DATA IN DIAGNOSTIC RADIOLOGY.
Vol. 1	Job Ladders: Assigning Tasks to Jobs.
Vol. 2	Curriculum Objectives for Radiologic Technology.
	(Volume 1 contains a mini-manual for developing performance evaluation instruments and carrying out an analysis of an institution's occupational structure.)
	(Volume 2 contains HSMS curriculum objectives. These can be used to train job analysts in using the HSMS skill scales, the Knowledge Classification System, and the HSMS knowledge scale. They can also be used as models for writing curriculum objectives.)
Working Paper No. 12	USING TASK DATA FOR PERFORMANCE EVALUATION AND PROFICIENCY TESTING. (tentative title)
	(Theory of criterion-referenced and norm-referenced testing; use of task data as inputs to testing. The HSMS theoretical document on occupational proficiency tests and issues of validity.)

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CHAPTER 1

THE HEALTH SERVICES MOBILITY STUDY METHOD

INTRODUCTION

Beginning in late 1967, the Health Services Mobility Study (HSMS) had the privilege of being allowed to develop a basic methodology to analyze (1) how the employer organizes work, (2) how employees can learn to do it, and (3) how individuals can be credited for work performance and preparation. HSMS has produced a new method of job and task analysis that can be used in the construction of job ladders and in the development of related curriculum guidelines. The work has been field tested in an ambulatory care setting and has been applied in diagnostic radiology, radiotherapy, and ultrasound. Although HSMS has concentrated on health services occupations, the method is designed for use in any industry or occupation.

Research Report No. 11 presents the method for others to use; it contains the entire HSMS methodology. Volume 1 is designed as an introduction to the method and contains the basic task analysis instruments. It is not a method manual. This volume presents the HSMS definition of task, the HSMS skill and knowledge scales, the HSMS Knowledge Classification, and an overview of the HSMS system.

Volume 2 is a method manual in the use of the task analysis instruments. It includes instructions for field work and in the use of the HSMS task definition, scales, and Knowledge System for a project head and job analysts.

Volume 3 is a method manual for the use of the task data in the design of rational job structures and job and career ladders. It presents the HSMS analytic methods, including the computer programs and their use. It also contains a scholars' review of the method.

Volume 4 is a method manual for the use of the analytic and task data in the design of curricula and educational ladders to parallel the job ladders.

Volume 1 is divided into three chapters. Chapter 1 provides an overview of the HSMS system and the basic concepts. Chapter 2 contains the HSMS definition of task, the HSMS scales (including the HSMS scale for task frequency, 16 skill scales, and the knowledge scale), and the basic data collection forms. Chapter 3 contains the HSMS Knowledge Classification System.

OVERVIEW

When an industry suffers from the related problems of labor shortages, scarce educational resources, lack of occupational mobility, and redundancy in credential requirements, a solution acceptable to employers, employees, and society is one that would make possible the attainment of efficient labor utilization, the elimination of occupational shortages, and the promotion of upward mobility.

HSMS has designed a system of analysis that makes it possible and practical to design job ladders, educational ladders, and evaluation instruments that make maximum use of the investment in human resources. The system takes into account the relationship among work tasks in terms of their skill and knowledge requirements. When socially desirable norms of performance are built into the task descriptions, they can be translated into curricula, instructional materials, and evaluation instruments, and can ultimately affect the quality of the work.

The HSMS method is sophisticated; the task identification and description phase is time consuming. However, the resulting materials are used as inputs for instruction, for the design of curricula, for the creation of performance evaluation instruments, and for the construction and validation of proficiency tests. Thus, in the long run, the time spent in developing the original data saves a good deal of time normally spent in curriculum design and test preparation.

The HSMS method can best be used to develop industry or regional prototypes so that individual employers and educational institutions can utilize the research results to suit their needs without the expense of separate research at each location.

Health Services Occupations

The health services industry is characterized by labor shortages in titles and functions which require credentialed, educationally-based skill and knowledge training, with few long-term labor shortages at the entry level. The industry dramatically embodies the labor market shift from goods producers to service producers, and from semi-skilled employees to technologists and professionals who require academically-based preparation.

In its earliest phase, HSMS found that the employment structure in health services delivery institutions (primarily hospitals and ambulatory care centers) is shaped like a pyramid. There are large numbers of semi-skilled employees found at entry levels, with the numbers declining at higher job levels. In contrast, the shortage structure in hospitals is shaped like a pyramid resting on its apex, with the largest number of shortages near the top. This set of circumstances makes these institutions ideal for the development of upward mobility programs that would utilize existing labor forces; yet almost all health occupations are at dead ends. HSMS concluded that artificial institutional and educational barriers have inhibited the upward mobility possible in the field of health services occupations.

Emerging health care functions continue to be hedged with credential barriers such as licensure or certification as soon as they appear. Professional associations spring up to guard or vie for new titles, regardless of the relationship of the new functions to existing titles and functions. As a result, there is a proliferation of credentialed health care occupations which overlap functions. Once they require credentials, these titles generally require formal, accredited educational preparation. The education programs usually assume no prior experience or training in health care, and, therefore, there is the problem of enormous overlap across educational programs.

In the past, the health services industry was also stultified by the sex images attached to the credentialed titles. In an industry in which the physician and hospital administrator was usually assumed to be male, and the nurse and dietary worker was usually assumed to be female, there had been a tendency to develop administrative enclaves in nursing and food service which ran as separate entities. Many trained female employees could only rise by assuming administrative functions within their domains, and thus gave up the very patient-oriented functions that attracted them to health care in the first place. Some of this is changing; more remains to be done to permit female health workers to rise to clinical specialties or enter medical schools with advanced standing.

HSMS Approach

The Health Services Mobility Study set itself the job of creating a basic method which would make possible the elimination of shortages through the systematic utilization and upgrading of existing staff. It sought to utilize prior education and experience to make possible upward mobility for individuals and thus make maximum use of educational resources. By focusing on what is learnable and transferable in the content of tasks, the educational links between jobs and tasks could be applied to the creation of job progressions (ladders).

After a review of the literature, HSMS came to the conclusion that, while there were several methods of job analysis in existence, no single method incorporated all the characteristics necessary to provide the basic data needed to design job ladders that would build on learnable and interrelated skills and knowledges. The existing methods did not fully account for the knowledges needed to perform tasks, and paid insufficient attention to learnable skills, particularly intellectual and interpersonal skills.

HSMS undertook the work knowing that certain pitfalls had to be avoided. The quality of professional-level service could not be distorted. The judgmental and theoretical aspects of professional service had to be respected, acknowledged, and accounted for. The intangibles leading to quality care, such as being sensitive to people's needs, caring for the quality of people's lives and health, being able to make decisions, see implications, and draw conclusions, all had to be incorporated into the system. The difference between rote performance of clinical procedures and the comprehending application of information and concepts also had to be taken into account.

All this has been accomplished. The HSMS method of task analysis involves task identification, task description, the rating of tasks for skill and knowledge requirements, and the grouping of tasks into interrelated hierarchies. The method includes processes for using task data to design job ladders, to develop curriculum objectives and educational ladders, and as inputs for the construction of evaluation instruments and proficiency tests.

Job Ladders

For HSMS, a job ladder is a logical progression from one job level to another within an interrelated grouping of tasks. Designed in this way, an individual's training for and experience in a lower-level job is preparation for the next level on the ladder; thus, the additional training and education needed for the next step on the ladder is kept to a minimum. If the progression up the job ladder reaches to professional levels, it can be called a career ladder.

The HSMS method makes it possible to analyze tasks in terms of skill and knowledge requirements, groupings, and job levels. From the point of view of management, this kind of analysis makes it possible to assign work duties to job titles rationally, to make optimum use of more highly trained and more expensive employees, and, at the same time, to have all the work carried out by staff who are properly trained to provide quality output. It makes little economic sense to assign low-level tasks to high-level personnel; it makes little social sense to assign high-level tasks to staff improperly trained to carry them out.

From the point of view of employees, the design of job ladders means that there is an opportunity to move ahead within the institution; the individual's investment in current training becomes an investment in the future. Success in the given job means mastery of skill and knowledges that will also be needed at higher levels; and future training can be expected to require related skills and knowledges, and/or higher levels of skills and knowledges already familiar in the current work. The next step up is also likely to be observable to the employee while he or she is operating in the current job.

From the point of view of society, the job ladder means that employees can be trained to reach their maximum potential and can also have socially useful, income-producing jobs along the way that reinforce their training. Each rung on the ladder is an interim option to work; but continuing education or later reentry to a program to continue up the ladder are also options. The work and training are not mutually exclusive; employees can support themselves and institutions can have the benefit of their training at one level while they are in preparation to move up to the next level on the ladder; the current work can only benefit from this.

The HSMS analytic approach also makes it possible to uncover lattice relationships among task groupings. While groups of tasks often have mutually exclusive skill and knowledge requirements, some groupings have a great deal of overlap. Cross-over possibilities are of interest especially when the investment in specialized training is not great. A lateral movement is possible from job to job at points where some of the training investment is still applicable, but where a change in the direction of the upward movement from one set of skills and knowledges to another is also possible.

Educational Ladders

The HSMS task analysis method makes possible the development of curricula for educational ladders to parallel job ladders. An educational ladder is a related, sequential set of educational courses or programs that provides for continuous educational movement to parallel the movement along a job ladder from its entry-level job to its highest-level job. An educational ladder provides exit credentials for each intermediary job that is reached at the end of each program in the sequence. Such sequences do not require repetition of course work when an individual reenters the educational process to continue up the ladder (aside from the necessary reinforcement or refresher work needed to bring the student up to date in competence).

For such upward mobility to be possible, the student must be able to build on his or her knowledge and skills in cumulative steps. The HSMS task analysis and curriculum design method assumes that a deep, broad understanding of a given knowledge area can be reached in successive, incremental steps. The method further assumes that skills are learned through practice, and can also be learned in incremental steps. The concept that skills and knowledges are teachable and additive is embodied in the HSMS skill and knowedge scales and makes it possible to design both job ladders and educational ladders.

HSMS task data can be used to identify the necessary curriculum content for each step on a ladder, and to identify the educational gap between levels. For any given task hierarchy, the difference between the highest scale value for each skill and knowledge category required at a particular job level and the highest scale value for skills and knowedges required at the next level, plus any new skills and knowledge categories needed at the next level, defines the educational gap between levels.

ANALYTIC INSTRUMENTS

The Task

If one conceives of all the kinds of work that get done in an institution or department in order for it to carry out its function and produce its products, one might think of a great field or pool of work. Each kind of work is carried out in discrete units. Theoretically, it does not matter how the units are allocated to jobs, as long as the work is done. In any given institution, the assignment of work units to jobs varies according to the size of the institution, local practices and laws, relative scarcities of types of manpower, and the extent to which an institution is rationally organized. This makes for lack of uniformity of work assignments by job title. In addition, although common sense is usually enough to discern that some work activities require more training than others, there are always areas where it is unclear to what job level work activities should be assigned.

The HSMS method avoids this issue until it is clear what the work activities are. Only at a second stage does the method determine the skill and knowledge requirements for the work units and, subsequently, their relative job levels.

The HSMS method begins with descriptions of all the work units, regardless of the job titles in which they are found. HSMS calls the work units "tasks." In the HSMS task analysis method, the tasks are identified by name, based on the HSMS definition of task, and the steps of the task are described in logical sequence including alternative ways of doing the task and contingencies. This differentiates the HSMS method from most other task analysis methods which simply identify tasks, usually with a vague definition, and with a brief name. The HSMS method includes a specific definition of task, an abbreviated name, a summary statement of the task, and a full task description.

In the HSMS method the collection of task descriptions is not like a sample survey. A sample survey would cover representative work at many locations and gather information on frequency and distribution. The HSMS method deals with a given task only once in order to describe the work procedures to which it refers for the purposes of developing instructional materials, curriculum objectives, and career ladders. For such purposes it includes, not only representative tasks, but all task activities, including accepted but rare or difficult procedures, emergencies, contingencies, and the best possible practice. The data are exhaustive, descriptive, and normative.

The HSMS definition conceives of the task as a work activity unit in which the "performer" combines existing technology, knowledge, materials, and equipment with skills to produce units of output. The definition is designed to result in the identification of a unit of work which can be moved from one job to another without disrupting other activities. The HSMS definition is presented in Chapter 2.

Once identified, a task has a code number, an abbreviated name, an extended name, and a full task description. The task descriptions present the task procedures in detail, in a logical sequence. The extended task name is a summary of the essential task steps, and the abbreviated task name is used for inventory purposes. The Task Code Number assigned to the task uniquely stands for the contents of the task wherever the task appears.

Skills, Knowledge and Scales

Each task requires that its performer utilize skills and knowledge at particular levels of achievement in order to carry it out.

With this in mind, the HSMS system includes a set of skill scales, a Knowledge Classification System, and a knowledge scale, all of which can be used in any work context. As a result, there is a consistent, underlying taxonomy that makes it possible to compare skill and knowledge requirements from one task to another.

The skills and knowledge categories have the property of being teachable (unlike aptitudes), so that all the information on tasks can be translated into the design of job ladders, curricula, and educational ladders.

Skills

A skill, as defined in the HSMS method, is displayed when an individual carries out a mental or physical activity. Detailed information and comprehension of the theory of specific disciplines or subject areas, and information on how things function or how to use them is knowledge. Applying or using the knowledge in a job task requires skills.

The critical distinction between skill and knowledge, given that they are both treated as teachable, is that skills require practice if they are to be learned. Knowledge is learned primarily through didactic means. Skills may sometimes be introduced in a didactic instructional setting, such as in a classroom or lecture room, but actual learning does not take place until there is practice. The basic component in what one learns through "experience" is skill.

We assume that when skills are taught the learned attributes of the skills are transferable and independent of substantive content. Skills can be taught and learned regardless of which procedures or knowledges provide the substantive content when the skill is applied. However, no skill can be learned without some substantive content. The implication is that what must be taught in each new situation are the knowledges and procedures of the situation. The skill, once learned at a given scale value, is available to the learner for use at that level in another context.

The HSMS method identifies sixteen skills. Of these, three are manual, two are interpersonal, three relate to precision in the use of language, two deal with decision making, four cover general intellectual skills, and two are responsibility skills which relate to the recognition of the consequences of error in task performance.

Scales

The HSMS method provides scales for rating the tasks on their skill and knowledge requirements. These are presented in Chapter 2. In addition to the sixteen skill scales, there is a knowledge scale, which is used with all the knowledge categories, and a task frequency scale for use in a given institution.

Each HSMS scale has a name, an overall statement of its content, and an indication of the criteria (scaling principles) which are to be used to differentiate each of its various numerical values. Each numerical scale value (which can range from 0.0 to 9.0) is accompanied by a statement (descriptor) which indicates the behavior warranting that descriptor's scale value. The descriptors are arranged in rising combinations of the scaling principles. They use generic language; so they can be used to scale any task.

The first descriptor for each scale is at the zero point. This descriptor contains more than the simple statement that the particular skill is not involved. Each defines the minimum condition which must be met before a task can be rated above zero on the scale. The minimum conditions for non-zero levels of the skill scales describe levels above common behavior that is assumed to be attainable with maturation. Thus, the zero point descriptor assures that non-zero values on the scales represent attributes that are needed at levels that require inclusion in a curriculum.

The HSMS scales were developed with the use of a statistical process known as Thurstone Scaling or equal-appearing intervals. As a result, the scales have the characteristics which permit them to be treated as statistical variables. It is the scale values of each task on the skill and knowledge "variables" that are the inputs to the statistical analysis.

The Knowledge Classification System

The HSMS Knowledge Classification System and the knowledge scale treat knowledge categories as variables which can be required for task performance. Thus, the tasks can be scaled for knowledge in a manner similar to the scaling of tasks for skills.

While "knowledge" can generally be considered to include all types of information, the HSMS Knowledge Classification System has a more limited approach. It is a taxonomy of knowledge categories, all of which can be conceived of as having a full range of levels of depth and detail.

Procedural knowledge without links to broader bodies of learning are excluded, as are procedures unique to an institution (orientation knowledge). These types of knowledge are either represented at particular scale values in other categories, or are not scalable. Though all knowledge must be accounted for in a curriculum, only scalable knowledge categories are usable as variables for the clustering of tasks into ladders.

The categories found in the HSMS Knowledge Classification System (presented in Chapter 3) are arranged in outline form. This is expressed as an eight-digit code system which designates a category's degree of indentation in the outline. Each category appears in only one location in the system, even if it is appropriate in more than one part of the outline.

Within the outline, only those categories which have a number sign (#) or are underlined (or both) are used for scaling purposes. The others are outline guideposts. The categories with number signs are called fine-level categories; those that are underlined are called broad-level categories.

The Knowledge Scale

The HSMS method uses a single scale for measuring the value at which tasks require any of the knowledge categories in the system. The scale is similar in concept to the skill scales. There are two scaling principles for the knowledge scale. These are: (1) breadth of knowledge and (2) depth of understanding. Breadth of knowledge refers to the amount of detailed knowledge the performer must know about the category. This covers the varieties of discrete information which are organized within the category, such as facts, terms, definitions, special procedures, and the use of special equipment. Depth of understanding, the second principle, refers to knowledge of the conceptual structure of the category named. The nature of the category determines the way depth of understanding is manifested.

The minimum condition needed for a task to be scaled at a non-zero value for a category is that the knowledge in the category be consciously applied in the task and represent a learning effort sufficient to be included in a curriculum.

COLLECTION OF DATA

The HSMS method is designed to be usable by persons who need not themselves be incumbents of the occupations to be studied. This makes it possible for the job analysts to study any type of job. The analysts must be trained in the method, including its definitions, procedures, and interview techniques. The method involves the collection of documents describing the work, terminology, and disciplines relevant to the jobs to be studied. This literature is used to familiarize the staff and analysts with the fields to be covered prior to their entry into the institution. The director and teams of two or more analysts are then able to deal intelligently with the material that they encounter. Having two or more analysts on a team ensures accurate and reliable data because one analyst can question the performer while the other records, and because members of a team are expected to agree on the data they submit.

Setting Up the Work at the Institution

Task analysis using the HSMS method proceeds in a series of stages. The method includes laying a groundwork during the scheduling period. During this time the job analysts ensure that information about the task analysis work is disseminated to all the managerial levels that must be involved in arranging interview time with the performers. The performers themselves are met and informed about the task analysis. Where employee organizations such as trade unions are involved, their cooperation is obtained.

Task Identification and Description

The data collection begins with task identification and description, which is done primarily through interviews with the performer, but which allows for some observation of tasks that are hard to describe without being seen.

With each "performer" interviewed, the job analysts first obtain an idea of all the work covered by that individual. The analysts then apply the HSMS definition of task (presented in Chapter 2) to break the work down into specific task units, making sure that nothing is left out. This is the task identification stage.

Once all the tasks are identified, the team of analysts reviews a listing of all the HSMS tasks already identified and described, regardless of location. The analysts make note of any tasks on the list which seem exactly the same as any that are newly identified. The task descriptions of these already-identified tasks are checked in the field, and, if a task description applies, the same code number is assigned, and an "overlap" task exists. Its description and skill and knowledge requirements are already known and no more work is needed for the task.

If the list and reading of existing task descriptions provide tasks that are similar to the ones newly identified, but with some differences in specific elements and/or apparent skill or knowledge requirements, the prior descriptions are used as models for the new task descriptions, and new code numbers are assigned.

To fully describe the new tasks, HSMS job analysts interview and sometimes observe performers at the institution. They write descriptions of how the tasks are done, including contingencies, alternative approaches, and emergencies that could arise in the tasks.

While this is going on, the project director and the analysts also review relevant current professional literature. The staff collect as much material as possible describing the work done in the area of interest, such as articles in professional journals, textbooks, operators' manuals describing equipment, current state and federal legislation, and proceedings of conferences dealing with safe practice, issues of patient care, or other appropriate quality concerns. There are also informal talks with professionals, educators, and people in government agencies. These often provide information on alternative methods for carrying out tasks, contingencies to be taken account of, varieties of equipment available, and some indication of which options are more desirable. An overview emerges as a result concerning procedures and activities which should be presented as tasks or within task descriptions, even if not always represented in current practice. These are called "desiderata."

The task descriptions are first written by the HSMS analysts and then go to the director for review and editing. The task identifications are critically reviewed for conformity to the HSMS definition, and, when necessary, the analysts are sent back to the field to obtain additional information. At this stage the tasks are rewritten to incorporate the literature of the field and the desiderata.

The next step involves critical review by professionals other than the performers who were interviewed by the job analysts. Normally there is a minimum of three reviewers.[1] The reviewers are asked to evaluate the tasks for correctness of language and sequence of procedures, to note omission of any tasks in the specialty area, and to indicate acceptable alternative methods. Reviewers are asked to concentrate on how the tasks should be done and, when appropriate, also to reflect national practice.

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[1] One reviewer is usually someone other than the performer whose work is being described who is at the institution where the material is being collected. At least two other reviewers are then obtained who are experts and in leading positions in institutions other than the one where the data were obtained. Sometimes all three reviewers come from outside the institution.

After the tasks are reviewed, the suggested changes are incorporated. Additional tasks are collected and described when necessary, and any new or totally revised tasks are resubmitted for review as described above. When a task has been reviewed and revised as required by at least three reviewers, it is referred to as a "normative task," or an "N task" and is so marked.

An Abbreviated Task Description Method

The full-scale application of the HSMS task analysis method produces detailed task descriptions for each work activity carried out in a specified area of interest. Each task identified is represented by detailed descriptions of the sequence of steps in the task and includes alternative ways of carrying out an activity when there are options for the performer.

Since each task is completely described, a task description can run for many pages. However, many tasks in a given functional area are quite similar, and, because each is self-contained, there is a good deal of repetition across such tasks. Many HSMS full-scale task descriptions differ from one another only in a few, although significant, ways. These uniformities across tasks can be consolidated in the preparation of behavioral objectives for curriculum design or for use as inputs for test construction. This became the basis of the shorter HSMS method of task description which many institutions with limited time and resources requested HSMS to develop.

In the HSMS brief method, some task descriptions are used as models when a series of tasks are similar in their basic structure. Other tasks are described with summaries that refer back to the models, and include details only for those parts of the tasks that are unique. These are called task summaries. The task summaries limit detail without sacrificing basic information. They can be scaled for skill and knowledge requirements using HSMS skill and knowledge categories and scales.

During task identification and task description there is a stage in which the analysts determine how the tasks can be grouped by function, within which tasks are similar in their basic sequences and procedures. For each such major function the analysts or the director decide the basis on which to differentiate one task from another. In the abbreviated method the staff determine whether one or two models can be written for a group of tasks with a similar function.

Task summaries which also draw on the literature in the field are written by the analysts or the director. The summaries first refer to the elements and sequences common to all the tasks that are based on a given model. Then the features unique to a given task are described. Task summaries that are not based on models can also be written in which the activity of each task element is named rather than described.

What Task Identification and Task Description Provides

The HSMS method of task identification and task description results in task data which have many potential applications. Some of these are as follows:

1. The HSMS definition of "task" results in the identification of units which can serve administrative needs. Each task is, by definition, a unit of work activity sufficiently self-contained to be moved from job to job or from employee to employee.
2. The definition of task and task identification procedures permit the user to find a task wherever it is being done, allowing for identification of task overlap across job titles or locations.
3. The HSMS definition of task permits distinctions to be made among tasks which reflect differences in basic knowledge, technology, or skills; it distinguishes tasks which cover a variety of contingencies or emergencies and tasks whose outputs are intangible.
4. The task descriptions and summaries can be used as instructional materials in the classroom and in clinical training. They provide ordered, logical sequences of steps. They suggest what contingencies, options, and emergencies are associated with the tasks, and, for the less familiar specialties, an indication of what is done in a given procedure.
5. The task descriptions and summaries can be used in the development of team training, since they refer to others in the procedures. The task analysis method can also be used as a management training device.
6. The task descriptions and summaries can provide an introduction to, or a basis for evaluation of, safe practice; they can be used to check on whether desired objectives are being accomplished and as a check on whether required steps or tasks are being carried out.
7. The task identifications, when combined with HSMS skill and knowledge data, are inputs to the HSMS method of designing job ladders and/or assigning tasks to occupational levels and titles.

8. The task descriptions and summaries, when combined with the HSMS skill and knowledge data, can become inputs in the development of performance-based curriculum objectives and educational ladders.

9. The task descriptions and summaries can be used as references for evaluation of work performance or as inputs to the development of job relevant proficiency tests (particularly for the selection of test content once the skill and knowledge data are collected).

10. The task descriptions and summaries can be used as objective references for the development of job descriptions, especially when edited to reflect the practices in a given institution.

11. The task descriptions can be used in occupational counseling and for purposes of consumer education.

12. The "extended task name," which summarizes the task in a paragraph-length statement, is sufficiently long to avoid ambiguity and is usable for task inventories when there is a need to quickly grasp the contents of a task for reference purposes.

13. The "abbreviated task name," which indicates the key features of the task, is useful for simple listings and task inventories.

Scaling The Tasks For Skills and Knowledge

After the tasks are in their final form they are scaled for their skill and knowledge requirements. The HSMS analysts scale each task on each of the skill scales; they identify the Knowledge Classification System categories needed to perform each task, and assign a scale value to each category using the HSMS knowledge scale. This process includes prescaling followed by interviews with the performers. When the analysts are sure of their scaling, they prepare forms which indicate, not only the scale values for skills and knowledges for each task, but the specific part of each task, i.e., the task language, to which a given scale value refers. This process ensures careful, reliable, and valid work on the part of the analysts, relevant data, and an input to curriculum design.

The skill and knowledge data go through an in-house check to ensure that the scales are being applied consistently and appropriately. Teams review each others' work,and a senior staff member reviews all the work, comparing the scaling for similar or related tasks and providing a check of consistency and accuracy.

The product for the given set of tasks at this stage is scale value data covering 16 skill variables and the number of knowledge category variables equal to the number of categories identified for the entire set of tasks. These data are coded for computer use and become inputs to the statistical analysis.

ANALYTIC PROCEDURES: AN OVERVIEW [2]

When all the tasks have been scaled for their skill and knowledge scale value requirements there is a raw data matrix in which the rows are tasks, the columns are the skill and knowledge variables, and the entries are the scale values. The HSMS purpose is to go from this basic data matrix to the assignment of tasks to job levels and recommendations on job ladders. The essential question is how to group a large number of tasks that require a large number of skills and knowledge categories at varying scale values into a meaningful smaller number of groupings so that the underlying association of skills and knowledges (variance) will be reflected in the groupings of the tasks. The next step is to go from such groupings of tasks to recommendations about job structures and job ladders.

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[2] A more technical description of the HSMS analytic techniques and an independent scholars' review appear in Volume 3 of this report.

The HSMS method employs a form of factor analysis called "principal components analysis" in a procedure we call "two-mode" factor analysis. It is used to assign tasks to groupings that require related skills and knowledges. The word "factor" means grouping. The way skills and knowledge categories group together in factors determines the way tasks can be grouped together in factors. Task factors are groupings of tasks that are interrelated.

The method assigns tasks to job levels by arranging tasks in a factor (group) so that tasks which require similar skills and knowledges at similar scale values are assigned to corresponding and appropriate job levels. (See Figure 1, below.)

The HSMS use of analytic techniques is descriptive. This is an applied use of statistics; the method does not build predictive models or engage in pure research. The statistical techniques serve to organize and simplify the data, and the results are suggestive. The steps carried out are as follows:

1. The tasks to enter the analysis are selected.
2. The skill and knowledge variables that have sufficient frequency to enter into the factor analysis are selected.

Figure 1. THE HSMS JOB LEVELS

HSMS Job Levels	Academic or Functional Description
8. Specialized Advanced Professional	MD's with specialization such as attending radiologists, internists, surgeons; doctorates and post doctorates with experience.
7. Advanced Professional	MD's in residency or doctoral candidates carrying out advanced functions.
6. Specialized Professional	Masters-level occupational study and experience; supervision of professionals.
5. Professional	At least four years of academic and/or specialized occupational education; may include masters level.
4. Junior Professional; Supervisor	Supervision and/or instruction of students and/or staff at levels 1, 2 and/or 3; may be equivalent to baccalaureate degree-level specialty.
3. Technologist	Specialized technologist education; equivalent to associate degree level.
2. Technician	Specialized technical education; up to, including, and beyond high school, but less than associate degree level.
1. Aide	Entry level; up to and including high school.

3. Principal component factor analysis is used to examine the structure of the variables. A solution (the number of factors) that best describes the relationship among variables is selected.

4. "Two-mode" factor analysis is used to examine the structure of tasks based on the structure of variables. Each task is assigned to a factor. The tasks are arranged in rank order within factors.

5. The tasks are arranged in rank order within factors by "difficulty," based on a count of all the skills and knowledges required for the tasks and the scale values at which they are required (including variables not part of the factor analysis). Tasks are then assigned to job levels within each factor.

The HSMS job ladder recommendations are arrangements of jobs in promotional steps derived from the task factors. The jobs in the ladder require interrelated skill and knowledge categories.

Job lattice recommendations allow for linkages across ladders both horizontally and diagonally. This provides cross-over options and a choice of promotional pathways. The principle involved is that the skills and knowledges required at a given job level for a factor may serve as a basis for more than one specialty. A given specialty may build on more than one kind of prior preparation; the entry to specific professional jobs could thus be reached through more than one factor. Conversely, a given job level in a factor can be a step towards more than one specialty.

CURRICULUM GUIDELINES: AN OVERVIEW[3]

The HSMS approach to education is that occupational preparation must be job relevant, must emphasize transferability of learning, and must be presented in additive units. This approach is reflected in the task data and is an underlying tenet of the HSMS curriculum design method.

HSMS task data and analytic techniques make it possible to specify a set of educational objectives (desiderata), offer a structured set of intended learning outcomes (curriculum objectives), and arrange these to provide an educational ladder. It is possible to offer suggestions for instruction and a set of instructional materials, namely, the task description. This total educational contribution to an occupational area is the HSMS curriculum guidelines.

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[3] A full description of the HSMS curriculum design method appears in Volume 4 of this report.

The HSMS curriculum design method utilizes the HSMS task descriptions, task data, and the assignment of tasks to factors and job levels. Each job level within each task factor is considered to be a discrete occupational and educational unit, and is treated separately.[4]

The units of curriculum are curriculum objectives. Each is stated as an intended learning outcome in the language of the task descriptions. The HSMS curriculum objectives are written as behavioral objectives, and describe the content which must be mastered and the behavior that is to be manifested. A curriculum objective is written for every skill and every knowledge category at each scale value required for any of the tasks covered by an occupational-educational unit.

There are three types of objectives: skill, knowledge, and procedural. The skill and knowledge objectives state in detail the content which must be learned in order to perform the tasks and specify the type of skill or the area of knowledge to be learned, the level of competence, and the task activities in which the content must be demonstrated or applied. By presenting the work behavior in combination with the skill or knowledge discipline in the curriculum objectives, the method assures job relevance, an academic context, and focuses on the desired end product. The procedural objectives cover the sequences in which the tasks must be performed; the task descriptions thus become instructional materials.

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[4] This provides program designers with the option of combining or separating the curriculum objectives for given skills and knowledges as appropriate to their needs while making educational ladders possible.

PROFICIENCY TESTS: AN OVERVIEW [5]

The HSMS methods of task analysis and curriculum design and the HSMS curriculum objectives provide an objective, logical, and focused set of materials for the selection of test content. The use of HSMS curriculum objectives as the source of test items can provide built-in content validity, because the objectives are taken directly from task descriptions and completely bypass classroom behaviors. The curriculum objectives provide professional standards because they are based on normative task descriptions which have been reviewed by leaders in the occupation. The experts thus provide inputs to the process where their expertise is relevant.

An HSMS behavioral curriculum objective defines the universe of content from which one can generate test items that measure competence in a particular work-related skill or knowledge, at a known level of difficulty.

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[5] A review of the issues involved in the construction of proficiency tests is presented in Working Paper No. 12, mentioned in the Preface of this report.

The information in each curriculum objective indicates the number of tasks for which the skill or knowledge at a given scale value is relevant. Thus, frequency across all the tasks of the occupation is known and can be used as a reference for weighting or to determine the centrality of the content.

The HSMS system is completed with performance evaluation and proficiency testing, discussed in Research Report No. 8 and in Working Paper No. 12. This completes the circle that begins with describing the work, goes on to teaching the work, and ends with evaluation of the work or the preparation.

CHAPTER 2

HSMS DEFINITION OF TASK, SCALES, AND DATA COLLECTION FORMS

This chapter presents the HSMS task definition and rules for its application, the HSMS task frequency scale, the sixteen skill scales, and the knowledge scale. It also presents the forms used for task descriptions and skill and knowledge scaling.

THE HSMS DEFINITION OF TASK

In the HSMS view, each work activity needed to produce products, including goods and non-tangible services, requires labor that will combine and apply existing technology, knowledge, materials, and equipment with skills to produce the units of output. The HSMS unit of work is the "task." It is conceptually smaller than a job as a whole, but it is large enough to have an identifiable, usable output which can be independently consumed or used, or which can serve as an input in a further stage of production by an individual other than the performer.

The steps of the task, or elements, unlike the task, do not have an identifiable output usable by someone other than the performer. The HSMS task definition is as follows:

> A task is a series or set of work activities (elements) which are needed to produce an identifiable output that can be independently consumed or used, or that can be used as an input in a further stage of production by an individual who may or may not be the performer of the task.

In order to facilitate use of the definition, HSMS analysts use the following rules:

1. In principle, someone other than the performer of the task must be able to use or consume the output of the task.
2. Theoretically, it should be possible for there to be an elapse of time between tasks.
3. A task includes all the possible conditions or circumstances with which a single performer is expected to deal in connection with the production stage or the output involved.
4. A task includes all the elements that require continuous judgment or assessment by the same performer in order to assure the quality of the output.
5. A task includes all of the elements needed to produce an output which can be independently used or acted upon without special explanantions to the next performer in the next stage of production.
6. A task includes all the elements needed to complete an output to a point at which another performer (who would continue with the next production sequence) would not have to redo major elements or perform extra steps in order to continue.
7. The task must include enough alternative minor elements to cover a variety of institutional arrangements so that another performer can continue with the next stage in a production sequence within current institutional arrangements.
8. A task must be sufficiently broad in statement that it can be rated on its frequency of occurrence.

The HSMS definition makes it possible to differentiate professional-level assignments which include decisions on what to do in emergency or contingency situations from those in which the performer notifies a higher-level performer of emergency signs. Such distinctions prevent incorrect conclusions about the existence of task overlap across job titles while permitting the user to uncover true overlap of tasks when it does occur.

WRITING TASK DESCRIPTIONS

The detailed task descriptions follow the format presented in Figure 2, the HSMS Task Description Sheet. At the top right is the task's Code Number. A code number is assigned to each task; it stands uniquely for the contents of the task, covering the task's output, what is used, the kind of recipient or respondent dealt with, and how the task is done. Regardless of the job title, institution, or industry in which the task is found, it always has the same Code Number. (The number itself has no intrinsic meaning.)

Items 1 through 4 on the Task Description Sheet appear on the left on page 1. These questions are used during the task identification stage to help the analysts differentiate one task from another. In item 1, the term "output" means an altered physical state of a thing or person, a changed mental state of a person, or a new item that can be used by consumers or can be used by other performers in carrying out their tasks. In item 2, "What is used" in a task includes all the things which the performer is expected to be able to use or choose from to produce the identified output.

In item 4, the "recipient, respondent or co-worker" involved in a task covers the special characteristics or condition of the kind of person with whom the performer must be trained to deal. For example, certain patient care procedures are carried out in the same way for all

Figure 2

HSMS TASK DESCRIPTION SHEET

Task Code No. _____

This is page 1 of ___ for this task.

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

3. Is there a recipient, respondent or co-worker involved in the task? Yes...( ) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

List Elements Fully

OK: RP;RR;RR

6. Check here if this is a master sheet..(X)

Figure 2

HSMS TASK DESCRIPTION SHEET (continued)

Task Code No. ____

This is page ___ of ___ for this task.

List Elements Fully	List Elements Fully

patients. These are "any patient" tasks. When the procedure is different according to the age level of the patient, different tasks are involved. For example, if an examination is carried out differently for children and adults, one task has "pediatric patient" recipients and the other "non-pediatric patient" recipients.

The "name of the task" (item 5 on the Task Description Sheet), summarizes the task in a paragraph-length statement. This is the "extended task name." The underlined portion of the statement is referred to as the "abbreviated task name." The latter is most useful for task inventory listings; the extended task name avoids ambiguity when the reference must be clear because the major steps are included.

The number of pages that the task runs is entered under the Task Code Number in the statement, "This is page ___ of ___ for this task." As the tasks are reviewed they receive notations such as "OK-RP;RR;RR," and are checked as master sheets on the lower right of the first page. RP stands for resource person, i.e., the in-house reviewer; RR stands for resource respondent, i.e., outside reviewer. In actual practice, there may be more than three reviewers; additional reviewers are not recorded on the sheet. After the task has had the required minimum of three reviewers, it is called a "normative" task.

The description of how the task is done begins with the "elements column" on the right on the first Task Description Sheet. The elements continue for as many pages as necessary on "continuation sheets."

The task summaries follow the format of Figure 3, the HSMS Task Identification Summary Sheet. The task's Code Number is entered

Figure 3

HSMS TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page ___ of ___ for this task.

Code

Performer's Name__________ Analyst(s)__________ Dept.__________
Job Title__________ Institution__________ Date__________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

3. Is there a recipient, respondent or co-worker involved in the task? Yes...( ) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

List Elements

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

Figure 3

HSMS TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page ___ of ___ for this task.

Code

Performer's Name______________________ Analyst(s)______________________ Dept.________
Job Title______________________ Institution______________________ Date________

List Elements	List Elements

at the top left. There is provision for counting the number of tasks for a given performer at the top right. The heading includes space to enter information related to the performer's name, job title, department, and institution, as well as the job analyst(s)' name(s) and the date. The right-hand column begins the list of elements; these are also continued on "continuation sheets." All other features are exactly the same as those in Figure 2. (Figure 2 is also used in the full-scale method when the analysts first collect the data and when the task descriptions are presented for review.)

Over the years, HSMS developed certain language conventions for writing the task descriptions. Some of these are as follows:

1. The person doing the task is always referred to as the "performer" regardless of his or her usual job title or rank. This provides a standard format and leaves for a later stage any battles over who should do what.

2. The task always begins with an initiating element that indicates how it comes about that the performer is doing the task.

3. Each task in the full-scale method is written so that it is complete within itself. Therefore, when there are similar procedures across tasks, there is repetition from task to task. In the short-cut method the repetition is minimized in "summary tasks." (The reason that the same or similar language is used to describe the same or similar activities is to assist analysts to spot elements that overlap from task to task for curriculum development purposes, even if this makes for dull reading. In the short-cut version of the method, overlap elements are eliminated in the task summaries, and reference is made to the model tasks which have full descriptions.)

4. When the task itself generates other tasks, certain phrases are used to signal this. Phrases such as "performer arranges...," "performer has...[done]" are examples. When a task may either be done by the performer or delegated, a separate task is generated. The signal for such tasks are phrases such as "...or decides to do personally," "performer plans to...," or "performer may decide to...".

5. When a particular part of a task represents an element that may or may not be done depending on institutional practice, personal preference, the state of the art, or the patient's condition, the phrase "performer may" or "may" is used before the description. Where the performer must make a choice as part of the task, this is made explicit: "performer decides," "performer considers whether...".

6. The specific content of some steps in a task, such as the choice of materials, or equipment, or information considered, may vary as the state of knowledge in the field changes or as new technology develops. There may be variations which reflect the condition of the patient, the equipment used, institutional facilities, or what was already done. There may also be variation of choices or steps reflecting current controversy or personal preference. The method does not attempt to present all the alternatives or to resolve these problems; it simply acknowledges them by the phrase "as appropriate" in such steps.

7. Many administrative and nursing tasks are generic and can be found in many departments. They are intentionally written in broad terms so that they can be picked up and recognized wherever they may appear. A given task that appears in different jobs, departments, or institutions is an "overlap" task, and always has the same Code Number.

THE HSMS SCALES

There are eighteen HSMS scales. These are presented below, followed by Figures 4 and 5. The latter are the forms used for scaling tasks for their skill requirements (Figure 4) and their knowledge requirements (Figure 5).

	HEALTH SERVICES MOBILITY STUDY SCALES	Page
Scale 1	Task Frequency	2-13
Scale 2	Locomotion Skills	2-15
Scale 3	Object Manipulation Skills	2-17
Scale 4	Guiding or Steering Skills	2-19
Scale 5	Human Interaction Skills	2-21
Scale 6	Leadership Skills	2-23
Scale 7	Oral Use of a Relevant Language	2-25
Scale 8	Reading Use of a Relevant Language	2-27
Scale 9	Written Use of a Relevant Language	2-29
Scale 10	Decision Making on Methods	2-31
Scale 11	Decision Making on Quality	2-33
Scale 12	Figural Skills	2-35
Scale 13	Symbolic Skills	2-37
Scale 14	Taxonomic Skills	2-39
Scale 15	Implicative Skills	2-41
Scale 16	Financial Consequences of Error	2-43
Scale 17	Consequences of Error to Humans	2-45
Scale 18	Levels of Knowledge	2-47

Scale 1. TASK FREQUENCY

This scale refers to the frequency with which the task being scaled is executed by the performer. Tasks which are regularly done should be scaled by using the wording outside of the parentheses in the statements presented below. Tasks which are done infrequently or in concentrated periods during the year should be scaled by using the wording within the parentheses; the figures represent conversions to a normal work year.

SCALE VALUE	DESCRIPTIVE STATEMENT
0	Task is never done.
1	Task is done once per year or less.
2	Task is done more often than once per year, but less than once per month (no more than 11 times per year).
3	Task is done once per month or more, but less often than once per week (no more than 33 times per year).
4	Task is done once per week or more, but less often than once per day (no more than 180 times per year).
6	Task is done once per day or more, but less often than five times per day (no more than 912 times per year).
7	Task is done five times per day or more, but less often than ten times per day (no more than 2,052 times per year).
8	Task is done ten times per day or more, but less often than fifty times per day (no more than 11,172 times per year).
9	Task is done fifty times per day or more (11,173 times per year or more).

Note: This scale is not used for clustering tasks. Ratings on this scale are relevant only at the level of the institution.

Scale 2. LOCOMOTION

This skill refers to the degree of body coordination required of a performer in the task being scaled. The skill involves the movement of the performer's body, torso or limbs through space in order to achieve predetermined standards of body movement or position.

The level of the skill rises with the degree of body coordination required. This is determined by the complexity of the standards involved, or the complexity of external conditions which restrict motion. The scale level is not determined by requirements for strength nor by the level of knowledge which may be required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to move his body, torso or limbs through space so as to achieve a predetermined standard for body motion or position.
1.5	The task requires the performer to move his body, torso, or limbs through space so as to achieve simple, predetermined standard(s) for body motion or position. A small degree of body coordination is called for.
5.0	The task requires the performer to move his body, torso, or limbs through space so as to achieve somewhat complex, predetermined standards for body motion or position. A moderate degree of body coordination is called for.
7.0	The task requires the performer to move his body, torso or limbs through space so as to achieve considerably complex, predetermined standards for body motion or position. A high degree of body coordination is called for.
9.0	The task requires the performer to move his body, torso or limbs through space so as to achieve extremely complex, predetermined standards for body motion or position. An extremely high degree of body coordination is called for.

Scale 3. OBJECT MANIPULATION

This skill refers to the degree of control required of a performer in directly manipulating objects in the task being scaled. The skill involves the direct handling of objects using fingers, hands or limbs to achieve a predetermined standard.

The level of the skill rises with the degree of precision required and with the fineness of the manipulation involved. When fingers, hands or limbs manipulate an object in order to manipulate another object, the skill level reflects the direct manipulation involving the fingers, hands or limbs. The scale level is not determined by the level of knowledge needed to manipulate objects nor by the level of other manual skills or Figural Skills required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to directly handle objects with the fingers, hands or limbs so as to achieve a predetermined standard within constraints that require control and precision.
1.5	The task requires the performer to exercise a small amount of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Fairly gross motions are involved.
3.5	The task requires the performer to exercise a moderate amount of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Fairly gross motions are involved.
5.0	The task requires the performer to exercise a moderate amount of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Fairly fine motions are involved.
7.5	The task requires the performer to exercise a high degree of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Fairly fine motions are involved.
9.0	The task requires the performer to exercise a high degree of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Extremely fine motions are involved.

Scale 4. GUIDING OR STEERING

This skill refers to the degree of precision required of a performer in the task being scaled in moving an object over a predetermined pathway or holding steady on a moving target. The skill involves coordinating the performer's perceptions of external stimuli which tell him his position with his control of the object, in relation to the desired position or movement. The predetermined pathway or moving target may be actual or visualized.

The level of the skill rises as the precision needed rises (or the relative margin for error declines), and as the complexity of stimuli or the number of spatial directions or movements involved increase. The scale level is not determined by the degree of arm-hand steadiness involved, nor by the Figural Skills involved, nor by the level of knowledge required to accomplish the guiding or steering.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to move an object over a predetermined pathway or hold steady on a moving target.
1.5	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a small degree of precision within a fairly large, acceptable relative margin of error. The performer must pay attention to a small number of external stimuli and/or spatial directions.
3.0	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a small degree of precision within a fairly large, acceptable relative margin of error. The performer must pay attention to a fairly complex set of external stimuli and/or spatial directions.
5.5	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a considerable degree of precision within a narrow, acceptable relative margin of error. The performer must pay attention to a fairly complex set of external stimuli and/or spatial directions.
7.0	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a considerable degree of precision within a narrow, acceptable relative margin of error. The performer must pay attention to an extremely complex set of external stimuli and/or spatial directions.
9.0	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a very high degree of precision within an extremely narrow, acceptable relative margin of error. The performer must pay attention to an extremely complex set of external stimuli and/or spatial directions.

Scale 5. HUMAN INTERACTION

This skill refers to the degree of sensitivity to others required of the performer in the task being scaled. The skill involves the performer's perception of the relevant characteristics or state of being of the other person(s), the performer's attention to feedback as the interaction occurs, and the performer's appropriate modification of his behavior so as to accomplish the task. The skill is involved if the task requires any personal contact or interaction with others.

The level of the skill rises as the degree of perceptiveness and sensitivity required of the performer rises, and as the subtlety of the feedback to which he or she must respond increases. The scale level is not determined by the level of knowledge required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to be in contact with or to interact with other people.
1.0	The task requires the performer to be in only general contact with other people. Very little sensitivity to or perception of the other person(s)' relevant general characteristics or state of being is required, and little awareness of very obvious feedback is required for the performer to adjust his behavior to perform the task.
3.0	The task requires the performer to interact with others in the performance of the task. The performer is required to be somewhat sensitive to or perceptive of the other person(s)' relevant general characteristics or state of being, and to be aware of very obvious feedback so as to adjust his behavior accordingly.
5.0	The task requires the performer to interact with others in the performance of the task. The performer is required to be quite sensitive to or perceptive of the other person(s)' relevant characteristics or state of being, and to be aware of fairly obvious feedback so as to adjust his behavior accordingly.
7.0	The task requires the performer to interact with others in the performance of the task. The performer is required to be keenly sensitive to or perceptive of the other person(s)' relevant characteristics or state of being, and to be aware of fairly subtle or complex feedback so as to adjust his behavior accordingly.
9.0	The task requires the performer to interact with others in the performance of the task. The performer is required to be keenly sensitive to or perceptive of the other person(s)' relevant characteristics or state of being, and to be aware of very subtle or very complex feedback so as to adjust his behavior accordingly.

Scale 6. LEADERSHIP
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This skill refers to the degree to which leadership in interacting with subordinates is required on the part of the performer in the task being scaled. The skill is involved when the performer's task requires him to interact with subordinates so as to affect their work performance in order for the performer to achieve goals related to the task. The subordinate relationship may be de facto as well as formal.

The level of this skill rises in relation to three aspects of the performer's relationship with subordinates which are relevant to the task situation. These are: (1) power over subordinates' conditions of employment; (2) clearness of mutual channels of communication; and (3) clearness of subordinates' own relevant task procedures.

Low levels of Leadership are required when the performer has a great deal of power over the subordinates' conditions of employment, when the performer has very formal and clearly defined channels of communication with the subordinates relevant to the task situation, and when the tasks of the subordinates related to the performer's objectives are very clear cut, obvious, and require little discretionary judgment.

High levels of Leadership are required when the performer's power is low, when channels of communication are vague and undefined, and when the relevant subordinates' tasks are vague and require a great deal of discretionary judgment.

The level of Leadership required for the task being scaled is determined by the combination of ratings of high, medium or low for each of the three aspects. The parentheses for each statement indicate the various combinations for each scale value.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to relate to subordinates.
1.0	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have a great amount of power over the related subordinates' conditions of employment. Channels of communication between the performer and the subordinates are very formalized and very well defined. The subordinates' related tasks are very clear cut, obvious and require little discretionary judgment. (Low range of Leadership needs on each of the three aspects. Also included: two lows and one medium.)

(continued on next page)

Scale 6. LEADERSHIP (continued)

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SCALE VALUE	DESCRIPTIVE STATEMENT
3.0	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have a moderate amount of power over the related subordinates' conditions of employment. The channels of communication between the performer and the subordinates are somewhat formalized and moderately well defined. The subordinates' related tasks are very clear cut, obvious, and require little discretionary judgment. (Mid-range of Leadership needs on two out of the three aspects and low on a third. Also included: two lows and one high.)
4.5	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have a moderate amount of power over the related subordinates' conditions of employment. The channels of communication between the performer and the subordinates are somewhat formalized and moderately well defined. The subordinates' related tasks are moderately clear cut, requiring some discretionary judgment. (Mid-range of Leadership needs on each of the three aspects. Also included: one low, one medium and one high; and two mediums and a high.)
6.5	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have a moderate amount of power over the related subordinates' conditions of employment. The channels of communication between the performer and the subordinates are very informal, vague or irregular. The subordinates' related tasks are vaguely defined and require a great deal of discretionary judgment. (High rating for Leadership on two out of three aspects.)
8.5	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have very little power over the related subordinates' conditions of employment. The channels of communication between the performer and the subordinates are very informal, vague or irregular. The subordinates' related tasks are vaguely defined and require a great deal of discretionary judgment. (High ratings for Leadership on all three aspects.)

Scale 7. ORAL USE OF A RELEVANT LANGUAGE

This skill refers to the level of precision in comprehension of heard language required of the performer in the task being scaled, and to the level of precision required in conveying meaning orally in the task situation. (The language referred to is the one in common use for the task.)

The level of this skill rises as the degree of precision in oral use of the language required in the task rises. The level of the scale is not determined by the knowledge reflected in the language used, nor by the skill of vocal delivery involved.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to understand spoken language or to speak.
2.0	The task requires the performer to understand and to convey meaning through the oral use of language. A low level of precision in choice of or comprehension of language is sufficient to accomplish the task.
4.0	The task requires the performer to understand and to convey meaning through the oral use of language. A moderate amount of precision in choice of or comprehension of language is necessary to accomplish the task.
7.5	The task requires the performer to understand and to convey meaning through the oral use of language. A fairly high degree of precision in choice of or comprehension of language is necessary to accomplish the task.
9.0	The task requires the performer to understand and to convey meaning through the oral use of language. A very high degree of precision and awareness of nuance in choice of or comprehension of language is necessary to accomplish the task.

Scale 8. READING USE OF A RELEVANT LANGUAGE

This skill refers to the level of comprehension required of the performer in his reading of written or printed material in the task being scaled. (The language referred to is the one in common use for the task.)

The level of this skill rises as the degree of precision in the reading use of the language required in the task rises. The level of this scale is not determined by the knowledge reflected in the material which is read.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to read and understand written language.
2.0	The task requires the performer to read and comprehend the general meaning of simple written language.
5.0	The task requires the performer to read and comprehend the general meaning of moderately complex written language.
7.0	The task requires the performer to read and comprehend the general meaning of complex written language.
9.0	The task requires the performer to read and comprehend the precise meaning and nuance of complex written language.

Scale 9. WRITTEN USE OF A RELEVANT LANGUAGE

This skill refers to the level of precision required of the performer in conveying meaning in the task being scaled through the written use of language. (The language referred to is the one in common use for the task.)

The level of this skill rises as the degree of precision in the written use of the language required in the task rises. The level of this scale is not determined by the knowledge reflected in the language used, nor by the level of knowledge of grammar or of literary form required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to write language.
2.0	The task requires the performer to convey general meaning by writing in simple language.
5.0	The task requires the performer to somewhat precisely convey meaning by writing in moderately complex language.
6.5	The task requires the performer to fairly precisely convey meaning by writing in complex language.
9.0	The task requires the performer to very precisely convey meaning by writing in very complex language.

Scale 10. DECISION MAKING ON METHODS

This skill refers to the degree of responsibility required of a performer with respect to decisions he must make about how he does the task being scaled. How the task is done (the method) includes what is done, when, in what order, what is used, and who is involved. When the performer has any amount of latitude in deciding how to do the task, the skill is involved.

The skill rises as the choice of methods in the task situation are less and less obvious or specified; the skill rises as the circumstances of the task from one instance to another are more and more varied. The level of this scale is not determined by the level of knowledge required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The performer is not required to decide on how to do any part of the task.
1.5	The performer is required to decide how to do all or part of the task. Instances of the task vary little with respect to the methods to choose from, and once the situation is known, the performer's choice is obvious and/or specified.
3.0	The performer is required to decide how to do all or part of the task. Instances of the task vary little with respect to the methods to choose from, and the performer's choice is arrived at by referring to general guidelines for choosing an appropriate method.
4.5	The performer is required to decide how to do all or part of the task. Instances of the task vary somewhat with respect to the methods to choose from, and the performer's choice is arrived at by referring to general guidelines for choosing an appropriate method.
7.0	The performer is required to decide how to do all or part of the task. Instances of the task cover a wide range of circumstances calling for very different methods, and the performer's choice is arrived at by referring to general guidelines for choosing an appropriate method.
9.0	The performer is required to decide how to do all or part of the task. Instances of the task cover a wide range of circumstances calling for very different methods, and once the situation is assessed, the performer must make his choice by applying his own guidelines for selecting an appropriate method.

Scale 11. DECISION MAKING ON QUALITY

This skill refers to the degree of responsibility required of the performer with respect to decisions he must make about the quality of the output he produces in the task being scaled. The scale refers to the performer's latitude beyond the minimum acceptable levels of task performance. The skill is involved when the performer has any effect on the quality of the task's output beyond minimum requirements.

The skill rises with the extent to which the performer can affect the output's quality. It is also affected by whether or not the output is subject to review or inspection by others before it is used. The level of this scale is not determined by the level of knowledge required nor by the possibility of making errors.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The performer is unable to affect the quality of the task's output.
1.5	The performer's exercise of choice in his standards of task performance can have only a minor effect on the quality of the task's output beyond minimum requirements, and the output is subject to complete and automatic review or inspection by someone else before it is used.
2.0	The performer's exercise of choice in his standards of task performance can have only a minor effect on the quality of the task's output beyond minimum requirements, and the output is subject to review or inspection by someone else before it is used.
3.5	The performer's exercise of choice in his standards of task performance can have only a minor effect on the quality of the task's output beyond minimum requirements, and the output is not subject to review or inspection by anyone else before it is used.
5.5	The performer's exercise of choice in his standards of task performance can have considerable effect on the quality of the task's output beyond minimum requirements, but the output is subject to review or inspection by someone else before it is used.
7.0	The performer's exercise of choice in his standards of task performance can have considerable effect on the quality of the task's output beyond minimum requirements, and the output is not subject to review or inspection by anyone else before it is used.
9.0	The performer's exercise of choice in his standards of task performance can completely determine the quality of the task's output due to the absence of minimum requirements, and the output is not subject to review or inspection by anyone else before it is used.

Scale 12. FIGURAL SKILLS

This skill refers to the level of complexity required of the performer in the task being scaled in dealing with figural aspects of materials. The skill involves the mental manipulation of figural properties in order to achieve a predetermined figural standard or objective. The figural aspects involved are limited to size, shape, form, or arrangement of materials in relation to space, whether the mental images involved or the materials dealt with are static or in motion. A figural standard would involve norms or criteria for size, shape, form or their arrangements in space.

The skill rises as the complexity of the figural standards which must be achieved to perform the task rise, and as the complexity of the figural relationships whose aspects the performer must deal with rise. The level of this scale is not determined by the level of knowledge nor by the level of manual skills required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to achieve a figural objective or standard involving size, shape, form, or arrangement of materials in relation to space, whether static or in motion.
1.0	The task requires the performer to achieve simple figural objectives, or meet simple figural standards involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their simple figural relationships.
3.5	The task requires the performer to achieve moderately complex figural objectives, or meet moderately complex figural standards involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their simple figural relationships.
5.0	The task requires the performer to achieve moderately complex figural objectives, or meet moderately complex figural standards involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their moderately complex figural relationships.
7.0	The task requires the performer to achieve moderately complex figural objectives, or meet moderately complex figural standards involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their highly complex figural relationships.
9.0	The task requires the performer to achieve highly complex figural objectives, or meet highly complex figural standards involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their highly complex figural relationships.

Scale 13. SYMBOLIC SKILLS

This skill is called for when the performer is required by the task being scaled to manipulate or use abstract symbols which are part of a system of symbolic notation. The skill involves the use of or manipulation of symbolic properties in such systems as numerical, musical, or code notations. The skill does not involve the semantic meaning or the figural properties of the symbols, nor use of single, one-to-one symbols which are not part of a system of notation, nor use of representational symbols.

The skill rises with the degree of complexity of the manipulation or use made of the symbols and with the complexity of the symbolic properties of the symbols. The level of this scale is not determined by the level of knowledge or subject matter represented by the symbols, nor by the figural properties of the symbols involved.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to manipulate or use abstract symbols which are part of a system of notation.
1.5	The task requires the performer to manipulate or use in simple operation(s), simple abstract symbols which are part of a system of notation.
3.5	The task requires the performer to manipulate or use in simple operation(s), fairly complex, abstract symbols which are part of a system of notation.
5.0	The task requires the performer to manipulate or use in fairly complicated operations(s), fairly complex, abstract symbols which are part of a system of notation.
7.0	The task requires the performer to manipulate or use in fairly complicated operation(s), highly complex, abstract symbols which are part of a system of notation.
9.0	The task requires the performer to manipulate or use in highly complicated operation(s), highly complex, abstract symbols which are part of a system of notation.

Scale 14. TAXONOMIC SKILLS

This skill is called for when the performer is required by the task being scaled to consciously apply or create conceptual classifying or organizing principles. The skill involves the application of mental processes to assign an unknown set of information to existing conceptual classes or systems, or the creation of conceptual classes or systems to suit the needs of the task. The skill does not involve the use of intuitive judgment, the use of simply figural or symbolic principles, or the one-to-one matching of obvious characteristics.

When conceptual organizing or classifying principles are to be applied, the skill rises with the level of complexity of the principles. When conceptual organizing or classifying principles are to be created, the skill rises with the level of complexity of the purposes they must serve in the task. The level of this scale is not determined by the level of knowledge nor by the level of the other intellectual skills required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to consciously apply or create conceptual principles of classification or organization.
2.0	The task requires the performer to consciously apply simple conceptual principles of classification or organization; or to create conceptual principles with which to organize or classify information to suit simple needs in the task situation.
5.5	The task requires the performer to consciously apply somewhat complex conceptual principles of classification or organization; or to create conceptual principles with which to organize or classify information to suit somewhat complex needs in the task situation.
7.0	The task requires the performer to consciously apply considerably complex conceptual principles of classification or organization; or to create conceptual principles with which to organize or classify information to suit considerably complex needs in the task situation.
9.0	The task requires the performer to consciously apply extremely complex conceptual principles of classification or organization; or to create conceptual principles with which to organize or classify information to suit extremely complex needs in the task situation.

Scale 15. IMPLICATIVE SKILLS

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This skill is called for when a performer must come to conclusions or draw implications in the task being scaled which go beyond the memorization of cause and effect relationships or simple associations. The skill involves the application of mental processes to deal with a set of information so as to draw non-routine conclusions or inferences or to foresee consequences in the performance of the task.

The skill rises with the degree of complexity of the information with which the performer must deal in drawing implications, and rises with the extent to which the kinds of information from which the conclusions or inferences are to be drawn vary from one instance of the task to another. The level of this scale is not determined by the seriousness of the errors in judgment which could be involved, nor by the level of knowledge, nor by the level of other intellectual skills required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of information.
1.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of relatively straight-forward or uncomplex information. The kinds of information from which the conclusions or inferences must be drawn vary little from one instance of the task to another.
2.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of relatively straight-forward or uncomplex information. The kinds of information from which the conclusions or inferences must be drawn vary somewhat from one instance of the task to another.
4.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of moderately complex information. The kinds of information from which the conclusions or inferences must be drawn vary little from one instance of the task to another.
5.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of moderately complex information. The kinds of information from which the conclusions or inferences must be drawn vary somewhat from one instance of the task to another.

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Scale 15. IMPLICATIVE SKILLS (continued)

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SCALE VALUE	DESCRIPTIVE STATEMENT
8.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of extremely complex or extremely ambiguous information. The kinds of information from which the conclusions or inferences must be drawn vary somewhat from one instance of the task to another.
9.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of extremely complex or extremely ambiguous information. The kinds of information from which the conclusions or inferences must be drawn vary a great deal from one instance of the task to another.

Scale 16. FINANCIAL CONSEQUENCES OF ERROR

This skill refers to the degree of responsibility carried by a performer with respect to the financial damage which could result from errors in his performance of the task being scaled. The error whose consequences would be rated would be the most serious likely error to be expected from a performer qualified to do the task. The skill is involved if errors in performance of the task have any financial consequences involving any output, equipment, materials, time or other chargeable items. The level of this scale is not determined by the value of insurance claims or damage suits which would result from harm to humans.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	No likely error in the performer's task performance could result in financial damage to the institution.
1.0	The most serious likely error in the performer's task performance would result in negligible financial damage to the institution.
4.0	The most serious likely error in the performer's task performance would result in financial damage to the institution of a relatively moderate but manageable amount.
6.0	The most serious likely error in the performer's task performance would result in financial damage to the institution of an amount considered to be relatively difficult to absorb.
7.5	The most serious likely error in the performer's task performance would result in financial damage to the institution of an amount considered to be extremely serious and extremely difficult to absorb.
9.0	The most serious likely error in the performer's task performance would result in financial damge to the institution of an amount so serious that the institution would cease to exist.

Scale 17. CONSEQUENCES OF ERROR TO HUMANS

This skill refers to the degree of responsibility carried by the performer with respect to the harm which could be done to humans as a result of errors in his performance of the task being scaled. The error whose consequences are rated would be the most serious likely error to be expected from a performer qualified to do the task. The skill is involved if errors in performance of the task result in any physical or mental harm to humans, including recipients, respondents, co-workers, or persons not directly related to the task. The performer is included. The level of this scale is not determined by any financial harm which could be done to persons.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	No likely error in the performer's task performance could result in harm to a human.
1.0	The most serious likely error in the performer's task performance would result in physical or mental inconvenience.
2.0	The most serious likely error in the performer's task performance would result in very minor physical or mental harm, requiring little or no remediation.
3.0	The most serious likely error in the performer's task performance would result in minor physical or mental harm and would require remediation or treatment.
5.5	The most serious likely error in the performer's task performance would result in considerable physical or mental harm and would require remediation or treatment.
7.0	The most serious likely error in the performer's task performance would result in very serious physical or mental harm, or would put the affected person in danger of minor permanent damage.
8.0	The most serious likely error in the performer's task performance would result in serious permanent damage beyond the help of remediation or treatment.
9.0	The most serious likely error in the performer's task performance would result in immediate and inevitable death.

Scale 18. LEVELS OF KNOWLEDGE

p. 1 of 2

This scale refers to the level of knowledge in a given subject category required of the performer in the task being scaled. The knowledge category is rated with this scale. To be rated above zero on the scale the task must require knowledge beyond the simple memorization of the overt steps of the task.

The scale rises with the amount of detailed knowledge which must be consciously applied and with the depth of understanding required in the subject area, in terms of the subject area's content, the structure of its ideas, and its uses. "Detailed knowledge" covers such things as technical or special terms or facts. "Consciously applied" means that the performer is able to (but need not) articulate his use of the knowledge in the task situation.

The level of knowledge for a category is not determined by the level of any intellectual skills required, nor by the level for any other knowledge category required for the task, nor by the level of the category required for any other tasks of the job involved.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to consciously apply knowledge in this subject category which has been gained in a learning experience requiring more than the memorization of the overt steps of the specific task being scaled.
1.5	The task requires that the performer consciously apply a limited amount of detailed knowledge in this subject category, including such things as technical or special terms, facts or equipment.
2.5	The task requires that the performer have a general awareness of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a limited amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.
3.5	The task requires that the performer have a general awareness of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a moderate amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.

(continued on next page)

Scale 18. LEVELS OF KNOWLEDGE (continued)
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SCALE VALUE	DESCRIPTIVE STATEMENT
5.5	The task requires that the performer have a considerable degree of understanding of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a moderate amount of detailed knowledge in this area, including such things as technical or special terms, facts or equipment.
7.0	The task requires that the performer have a considerable degree of understanding of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a very great amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.
8.0	The task requires that the performer have a very deep understanding of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a moderate amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.
9.0	The task requires that the performer have a very deep understanding of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a very great amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.

Figure 4

HSMS SKILL SCALING SHEET

Task Name ______________________________ Task Code No. ______

Institution ____________________ Analysts ____________________

Scale	Circle Appropriate Scale Value for Each Scale																	
	0	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9
1 Frequency	0	1		2		3		4				6		7		8		9
2 Locomotion	0		1.5							5				7				9
3 Object Manipulation	0		1.5				3.5			5					7.5			9
4 Guiding or Steering	0		1.5			3					5.5			7				9
5 Human Interaction	0	1				3				5				7				9
6 Leadership	0	1				3			4.5				6.5				8.5	
7 Language: Oral Use	0			2				4							7.5			9
Insert name(s) of language(s):																		
8 Language: Reading Use	0			2						5				7				9
Insert name(s) of language(s):																		
9 Language: Written use	0			2						5			6.5					9
Insert name(s) of language(s):																		
10 Decision: Methods	0		1.5			3			4.5					7				9
11 Decision: Quality	0		1.5	2			3.5				5.5			7				9
12 GIS: Figural	0	1					3.5			5				7				9
13 GIS: Symbolic	0		1.5				3.5			5				7				9
14 GIS: Taxonomic	0			2							5.5			7				9
15 GIS: Implicative	0	1		2				4		5						8		9
16 Error: Financial	0	1						4				6			7.5			9
Insert error:																		
17 Error: Human	0	1		2		3					5.5			7		8		9
Insert error:																		

Check here if this is a master sheet . . . ( )

Circle the pre-entered scale value chosen for each scale.

Figure 5

HSMS KNOWLEDGE IDENTIFICATION SHEET

Task Name ______________________________ Task Code No. ____
______________________________ Analysts ______________________
Institution ______________________ page __ of __ for this task

For every category chosen: remember to examine whether, if you have chosen a broad-level category, any of the related finer-level break-outs apply; whether, if you have chosen a fine-level break-out, the related broad level category applies.

Abbreviated Knowledge Classification System Name	Knowledge System 8-digit ID	Scale Value

Check here if this is a master sheet...( )

CHAPTER 3

THE KNOWLEDGE CLASSIFICATION SYSTEM

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  - Genetics 3-7
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SYMBOLS USED IN THE KNOWLEDGE SYSTEM

(________)	Underline represents "broad level category" which can be identified for tasks.
(#)	Number sign represents "fine level category" which can be identified for tasks.
(*)	Asterisk represents acknowledgment that category obviously requires additional subdivisions.
(SS)	See Special Section on Category Characteristics for comments on this category. (Begins on page 3-155.)

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10000000		NATURAL SCIENCES
11000000		BIOLOGICAL SCIENCES
11100000		# History of the biological sciences*
11200000		# Genetics (For molecular and microbial genetics see Molecular biology.)*
11300000		# Evolution*
11400000		# Biogeography*
11500000		# Ecology (Includes ecosystems and conservation.) (For the physical aspects of air pollution see GEOSCIENCES, CHEMISTRY, PHYSICS, and ENGINEERING AND TECHNOLOGY; for the health aspects of pollution see Community health and preventive medicine and Epidemiology.)
11600000		# Botany*
11700000		Zoology
11710000		# Invertebrate zoology*
11720000		# Vertebrate zoology (through mammalia, but excluding humans)*
11730000		Human zoology
11731000	SS	Normal structure and function (The categories listed below include both anatomy and physiology except where otherwise specified.)
11731100	SS	# Regional anatomy (Includes head and neck, thorax and abdomen, pelvis and perineum, lower and upper limbs, and skeleton.)
11731200	SS	# Topographic anatomy (relation of external manifestations to internal structure and function, e.g. location of pressure points, surface appearance of joints, muscles and bones.)
11731300	SS	# Hematopoietic system (Includes blood, red and white blood cells, platelets, and bone marrow, liver and spleen in their blood forming function.)

1 2 3 4 5 6 7 8

Normal structure and function (continued)

11731400		# Circulatory system (cardiovascular system) (Includes heart, veins, arteries, lymphatics.)
11731500	SS	# Respiratory system
11731510		Upper respiratory system (Includes nasal cavity, paranasal sinuses, and the pharynx in its respiratory function.)
11731520		Lower respiratory system (Includes larynx, trachea, and bronchi.)
11731530		Lungs and diaphragm
11731600	SS	# Digestive system
11731610	SS	# Mouth, pharynx (digestive function), and esophagus (Includes tongue, teeth, and salivary glands.)
11731620		# Stomach and small intestine (Includes duodenum, jejunum, ileum.)
11731630		# Large intestine (colon) and rectum (Includes appendix, anus, and mesentery.)
11731640		# Liver, biliary system, and pancreas (Includes gall bladder, cystic duct, bile duct, pancreatic duct, ampulla of Vater.)
11731700		# Urinary system (Includes kidney, ureter, bladder, urethra, external genitalia.)
11731800		Musculo-skeletal system
11731810		# Muscles
11731820		# Bones and joints (Includes ligaments and tendons.)
11731830		Integument
11731831		# Skin and sweat glands
11731832		# Hair
11731833		# Nails

1 2 3 4 5 6 7 8

Normal structure and function (continued)

11731900		# Nervous system
11731910		# Central nervous system (brain and spinal cord)
11731920		# Peripheral nervous system
11731930	SS	# Autonomic nervous system (Includes sympathetic and parasympathetic nerves.)
11731940		Organs of special senses (See also Sensation in BEHAVIORAL SCIENCES.)
11731941		# Olfactory nerve and receptors
11731942		# Taste buds
11731943		# Eye and optic nerve
11731944		# Touch, heat, cold and pain receptors
11731945		# The ear (Note that this category excludes balance function.)
11731946		# Kinesthetic receptors (Includes semicircular canals.)
11732100	SS	# Immunologic system (Includes immunological mechanisms, humoral and cellular factors.)
11732200		Endocrine system and reproduction
11732210		# Endocrine glands and their hormone physiology (Includes pituitary, adrenal, thyroid, parathyroid, pineal, and pancreas, ovary and testes in their endocrine functions.)
11732220		# Reproduction
11732221		# Conception and contraception
11732222		# Male reproductive system

1 2 3 4 5 6 7. 8

Reproduction (continued)

11732223		# Female reproductive system (Includes the body changes associated with ovulation, conception and pregnancy, e.g. development of placenta.) (For development of the embryo see Growth and development.)
11732300	SS	# Homeostasis of fluids (Includes fluid and electrolyte balance.)
11732400	SS	# Metabolism
11733000	SS	Pathology (abnormal function and structure) (Includes the etiologic and diagnostic aspects of disease.) (See also First aid for emergency treatment and care and Radiobiology.)
11733100		# Infective and parasitic diseases
11733200		# Neoplasms (cancerous growths)
11733300		# Endocrine, nutritional, and metabolic disorders
11733400		# Disorders of blood and blood-forming organs
11733500		Disorders of the nervous system and sense organs (For mental disorders, see Psychopathology in the BEHAVIORAL SCIENCES.)
11733510		# Disorders of the central nervous system
11733520		# Disorders of the peripheral nervous system
11733530		# Disorders of the autonomic nervous system
11733540		Disorders of the organs of special senses
11733541		# Disorders of the olfactory nerve and receptors
11733542		# Disorders of the taste buds

1 2 3 4 5 6 7 8

		Disorders of the organs of special senses (continued)
11733543		# Disorders of the eye and optic nerve
11733544		# Disorders of touch, heat, cold and pain receptors
11733545		# Disorders of the ear
11733546		# Disorders of kinesthetic receptors
11733600		# Disorders of the circulatory system
11733700		# Disorders of the digestive system
11733800		# Disorders of the respiratory system
11733900		# Disorders of the uro-genital system
11734100		# Disorders of the skin and subcutaneous tissues
11734200		# Disorders of the musculoskeletal system and connective tissues
11734300		# Congenital abnormalities
11734400		# Disorders and complications of pregnancy, childbirth and the puerperium
11734500	SS	# Perinatal morbidity and mortality (shortly before or after birth)
11734600		# Burns
11734700		# Poisoning
11734800	SS	# Shock and trauma
11735000	SS	Surgery
11735100		# Operative procedures (Also includes biopsy, removal of tumors, removal of organs, Caesarian section, removal of drains.)
11735200		# Amputation and disarticulation
11735300		# Repair surgery (Includes plastic surgery, pedicle revision, surgical graft, anastomosis, fistulization, open reduction, fixation, fusion, stabilization.)

1 2 3 4 5 6 7 8

Surgery (continued)

11735400	SS	# Introductory procedures (Includes injections, transfusion, irrigation, catheterization, intubation, tracheotomy.)
11735500		# Endoscopy (direct visual observation of bronchi, esophagus, duodenum, colon, etc. with an endoscope)
11735600		# Suture (Also includes ligature, suture materials.)
11735700	SS	# Manipulation (Includes application of plaster, splint or traction, dilation or stretching.)
11735800		# Delivery methods for childbirth (Includes the circumstances governing the delivery method chosen such as abnormal presentation of baby (transverse section, breech), medical history of mother.) (For complications of childbirth caused by other conditions see Pathology, Normal structure and function.)
11736000		# Anesthesiology (Includes open anesthetics, semiopen, insufflation, absorption, intravenous, infiltration, field and nerve block methods.) (For administering anesthesia see also Surgery.)
11737000		First aid and care (See also Pathology.)
11737100	SS	# Bandages, dressings, tourniquets and splints
11737200		# Hemorrhage and bleeding and their arrest
11737300		# Handling and transportation of the sick or wounded
11737400	SS	# Sprains, strains, fractures and their healing
11737500		# Foreign bodies not involving wounds (in eye, throat)
11737600		# Resuscitation
11737700	SS	# Wounds and their healing (Also includes operative incisions.)

1 2 3 4 5 6 7 8

Human zoology (continued)

11738000 SS # Asepsis (concepts and techniques involved in achievement of sterile condition) (Includes concurrent and terminal disinfection during surgery, aspects of sterilization of implements and equipment such as autoclaving.)

11739000 Community health and preventive medicine (For health education see topics of instruction and EDUCATION.)

11739100 # Treatment of social causes of illness (primary level of prevention) (See also SOCIAL SCIENCES.)

11739200 # Making diagnosis, referral and treatment available (secondary level of prevention)

11739300 # Rehabilitation and restoration of individual to community (tertiary level of prevention) (See also Behavioral processes and Rehabilitation medicine.)

11739400 Health aspects of enviromental pollution (For physical aspects see NATURAL SCIENCES, ENGINEERING AND TECHNOLOGY and GEOSCIENCES.)

11739410 # Air and water pollution*

11739420 # Noise pollution

11739430 SS # Sanitation (establishment and maintenance of environmental conditions which are favorable to health) (Includes methods of waste disposal, sanitary considerations for food and drink, insect and rodent control.) (For clinical sterilization techniques see Asepsis.)

11741000 # Epidemiology (relationship of factors which determine the frequencies and distributions of infectious processes, diseases or other pathological states (e.g. lead poisoning) in human communities) (Also includes immunization.) (See also Asepsis and Pathology.)

1 2 3 4 5 6 7 8

Human zoology (continued)

11742000 Rehabilitation medicine (For normal functioning and diseases see Normal structure and function and Pathology; for physical education see EDUCATION for the teaching techniques involved and the appropriate categories for for topics of instruction; for therapeutic diets see Nutrition and dietetics.)

11742100 SS Physical therapy (Excludes speech therapy and hearing therapy.) (See also Mental retardation in the BEHAVIORAL SCIENCES and Special education in EDUCATION.)

11742110 # Kinesiology and body mechanics (See also Musculo-skeletal system; for disability see Disorders of the musculo-skeletal system.)

11742120 # Disability evaluation (testing and measurement to determine the extent and type of physical disability) (For psychological tests see BEHAVIORAL SCIENCES.)*

11742130 Treatment types

11742131 # Amputation adjustments (Includes artificial limbs and their use and artificial organs [where relevant] and their use.) (Note that this category excludes surgical procedures.)*

11742132 SS # Corrective, preventive and compensatory adjustments (Includes supportive and self-help devices and their use, such as wheel chairs, trusses, crutches and other mechanical devices and special measures to restore functioning, prevent malfunction (e.g. after surgery), and to make use of partial functions.)*

1 2 3 4 5 6 7 8

	Treatment types (continued)
11742133 SS	# Special post-disease and chronic disease therapy (special corrective procedures for the after-effects of diseases such as heart disease, rheumatic fever, epilepsy, blindness, diabetes, pulmonary tuberculosis.)*
11742140	Treatment modalities (for physical disabilities)
11742141	# Hydrotherapy (Includes whirlpool baths.)
11742142	# Electrotherapy (use of electric current for therapeutic purposes)
11742143	# Heat therapy (Includes diathermy, infra-red, ultra-violet.)
11742144	# Deep heat therapy (Includes short wave, micro-wave, ultrasound.)
11742145	# Fever therapy (production of artificial fever for therapeutic purposes)
11742146	# Cold therapy (therapeutic use of cold)
11742147	# Massage (systematic manipulation of body tissues for therapeutic purposes)
11742148	# Exercise (corrective therapeutic and normal) (Includes active, passive and stretching, active assistance, isometric, progressive resistive (proprioceptive, isotonic), coordination and balance, breathing, prenatal and post partum, gait-training and locomotion exercise.)
11742149	# Therapeutic recreation

1 2 3 4 5 6 7 8

Treatment modalities (continued)

11742151 # Vocational rehabilitation (Refers only to the physical therapy aspects of vocational rehabilitation.) (See also Psychotherapy and counselling in the BEHAVIORAL SCIENCES.)

11742200 Speech therapy and hearing therapy (See also Normal structure and function, PHYSICS and LINGUISTICS.)

11742210 # Speech therapy*

11742220 # Hearing therapy*

11743000 Nutrition and dietetics (See also CHEMISTRY, Normal structure and function, Cell biology.)

11743100 # Biochemistry of nutrients (Includes carbohydrates, fats, proteins, minerals, vitamins, water.)

11743200 # Physiology of nutrients (Includes carbohydrates, fats, proteins, minerals, vitamins, water.)

11743300 # Nutritional qualities of foods (Includes losses resulting from processing, the relationship between foods their preparation and their nutritive content.)

11743400 # Nutritional requirements and diets (Includes normal and therapeutic nutrition for adults, pregnancy and lactation, infancy, childhood, adolescence, and geriatrics.)

11744000 Dentistry (See also Anesthesiology.)

11744100 # Oral hygiene and care (See also Asepsis.)

11744200 # Oral surgery (surgical and adjunctive treatment of diseases, injuries, and defects of the mouth, the jaws, and associated structures) (Includes fillings, pedontics, and corrective devices such as dentures, crowns, bridges.) (See also Surgery.)

1 2 3 4 5 6 7 8

Dentistry (continued)

11744300	# Orthodontics (prevention and correction of irregularities of the teeth and malocclusion, and with associated facial problems)
11745000	Growth and development (Note that age ranges are approximate.) (For psychological aspects of growth and development see Behavioral processes.)
11745100	# Embryology and prenatal period (For experimental embryology see Cell biology.) (See also Chemical teratogenesis.)
11745200	# Neonatal period (birth through 1st month)
11745300	# Infant growth (2nd month through 2nd year)
11745400	# Childhood growth
11745500	# Adolescent growth
11745600	# Adulthood
11745700	# Old age (geriatrics)
11745800	# Death and dying
11800000	# Microbiology (Includes physiology of microorganisms such as protozoa, fungi, algae, bacteria.) (For parasitology see Infective and parasitic diseases.)
11900000	# Molecular biology (Includes viruses; the genetics of bacteria, and molecular and microbial genetics.) (For biophysical aspects of molecular biology see CHEMISTRY.)
12100000	Cell biology (cytology and histology)
12110000	# Cell morphology (structure)
12120000	# Cell physiology
12130000	# Cyto-chemistry (histo-chemistry)
12140000	# Neurobiology (cellular level)
12141000	Adrenergic systems

1 2 3 4 5 6 7 8

Neurobiology (continued)

12142000	Cholinergic systems
12150000	# Developmental biology (Includes experimental embryology.)
12151000	Cell-cell interactions
12152000	Control of differentiation and specialization of tissues
12200000	Radiobiology and radiology
12210000	# Radiobiology (effects of high energy radiation on living organisms) (Includes effects of ionizing electromagnetic, ultraviolet, sonic and particulate radiation.) (Also includes biological safety requirements and protection.) (For specific technological applications see appropriate categories under CHEMISTRY, PHYSICS, ENGINEERING AND TECHNOLOGY. For specific disease and functional effects of radiation see also Normal structure and function, Pathology, Genetics, Cell biology.)
12220000	Radiology (diagnostic and therapeutic application of radiant energy including electromagnetic and particulate radiation) (See also CHEMISTRY, PHYSICS, ENGINEERING AND TECHNOLOGY, Normal structure and function, Pathology, First aid and care, Radiobiology, for all categories listed below.)
12221000	# Radiotherapy (application of electromagnetic and particulate ionizing radiation to living organisms for therapeutic purposes) (Includes determination of course of treatment and administration of treatment.)
12222000	## Radionuclide therapy (part of nuclear medicine; internal application of unsealed sources of particulate radiation (radioactive materials) to living organisms for therapeutic purposes) (Includes determination of course of treatment and use of radionuclides.)
12223000	# Diagnostic radiography (application of electromagnetic ionizing radiation such as x-rays to achieve interpretable images for diagnostic purposes) (Also includes fluoroscopy, use of related techniques, contrast media, procedures, positioning, interpretation of images.)
12224000	# Radionuclide analysis (part of nuclear medicine; internal application of unsealed radioactive nuclides to living organisms for the purpose of diagnosis or investigation) (Includes use of radioisotope scanning (tracer techniques), related procedures, positioning.) (See also Radiochemical analysis, Radiochemistry.)

12300000 SS	Pharmacology (the study of drugs, i.e. chemical compounds or non-infectious biological substances which may be administered as an aid in the diagnosis, treatment or prevention of disease, for the relief of pain or suffering, or to control or improve any physiological or pathological condition) (See also Normal structure and function, Pathology, Cell biology and CHEMISTRY.)
12310000	Molecular mechanisms of drug action
12311000	# Drug receptor theory (Includes bond types in drug receptor interaction.)
12312000	# Drug structure-activity relationships
12313000	# Drug dose-response relationships
12314000	# Non-receptor mediated drug action
12320000	Drug physiology and chemistry (See also Normal structure and function, Pathology, Cell biology and CHEMISTRY.)
12321000	# Drug absorption (Includes physiochemical nature of the drug, physiochemical nature of absorbing membrane, route of administration.)
12322000	# Drug distribution (Includes volume of distribution, drug-plasma protein interaction, drug-membrane interactions, drug deposition and storage.)
12323000	# Drug excretion (Includes physiochemical nature of the drug, routes of elimination.)
12324000	# Drug metabolism (Includes oxidation, reduction, hydrolysis, conjugation.)
12330000	Adverse effects of drugs and responsible mechanisms (See also Normal structure and function, Pathology, Cell biology and CHEMISTRY.)
12331000 SS	# Drug toxicity (Includes antidotal therapy.)
12332000 SS	# Drug idiosyncrasy and allergy pharmacogenetics (Includes increased sensitivity to drugs, decreased responsiveness to drugs, novel drug effects, etc., which are due to inherited physical characteristics.)
12333000	# Drug resistance (of a non-genetic nature) (Includes mutational origins.) (For biochemical mechanisms, see CHEMISTRY.)
12334000	# Drug tolerance and physical dependence (Includes homeostatic adjustment, cumulative effects, tolerance at the site of drug action.)

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Adverse effects of drugs and responsible mechanisms (continued)

12335000 SS # Drug synergism (presence of two or more drugs in the body having interaction effects and the change in drug action this causes)

12336000 # Chemical teratogenesis (special effects of drugs on the fetus during pregnancy)

12337000 SS # Chemical mutagenesis (drugs which induce mutation, a discontinuous inheritable change in the quality of the offspring,used to inhibit growth of malignant tissues by destroying or modifying the genes.)

12338000 # Chemical carcinogenesis (the range of drugs which can induce tumors)

12340000 Drug classes (See also Normal structure and function, Pathology, Cell biology and CHEMISTRY wherever applicable.)

12341000 Drugs acting on foreign invaders

12341100 # Antibacterial and antifungal chemotherapy (Includes antiseptics and germicides, sulfonamides, penicillins, erythromycin, tetracyclines and broad spectrum antibiotics, streptomycin, sulfones, antifungal agents.)

12341200 # Antiprotozoal/antimetazoal chemotherapy (Includes antimalarials, amebicides, heavy metals, metal-binding agents, antimonials, anthelmintics.)

12341300 # Cancer and virus chemotherapy (Includes alkylating agents, antimetabolites, steroids and enzymes, interferon induction.)

12341400 # Local chemotherapy (Includes insecticides, repellents, and rodenticides, topical agents.)

12342000 Drugs acting on somatic systems

12342100 # Drugs acting on the cardiovascular system and smooth muscle (Includes cardiac glycosides, quinidine and anti-arrhythmia agents, coronary vasodilators, diuretics, agents inhibiting the renal tubules, fluids (such as blood, substitutes, electrolytes), agents in atherosclerosis, hypotensive agents, smooth muscle relaxants, smooth muscle stimulants.)

12342200 # Drugs acting on the blood (Includes agents in anemia, anticoagulants and coagulants.)

1 2 3 4 5 6 7 8

Drugs acting on somatic systems (continued)

12342300	# Hormones and drugs acting on endocrine glands and accessory reproductive organs (Includes adrenal cortical hormones and corticotropin, thyroid and thyrotropic hormones, sex hormones and gonadotropins, anterior pituitary, agents in diabetes mellitus, parathyroid hormone and calcium metabolism.)
12342400	# Vitamins and nutritional agents (Refers only to the pharmaceutical aspects.) (Includes vitamins, agents in nutrition and obesity.) (For nutritional and dietary aspects see Nutrition and dietetics.)
12342500	# Drugs influencing growth and development
12342600 SS	# Drugs for allergy, cough, vomiting and the dermatomucosal surfaces (Includes anti-immune drugs, antitussives, antiemetics, dermatomucosal agents.)
12342700	# Drugs acting on the gastrointestinal tract (Includes drugs effective in ulcer therapy, cathartics and laxatives, digestants and drugs useful in gallbladder disease.)
12342800	# Drugs acting on the nervous system (For anesthetics see Anesthesiology.)
12342810	# Drugs acting on the autonomic nervous system (Includes sympathetic stimulants, sympathetic depressants, parasympathetic stimulants, parasympathetic depressants, ganglionic agents.)
12342820	# Drugs acting on the neuromuscular system (Includes myoneural agents, muscle relaxants.)
12342830	# Drugs acting on the central nervous system (Includes narcotic analgesics, non-narcotic analgesics, sedatives and hypnotics, anticonvulsants, tranquilizers, drug addiction, alcohol, psychomimetic agents, drugs affecting the mind.)
12342900	# Drugs acting on the immunologic system

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NATURAL SCIENCES (continued)

13000000		CHEMISTRY
13100000	SS	Physical chemistry
13110000		# Molecular quantum mechanics
13111000		Numerical wave functions (Includes ab initio and semi-empirical theories.)
13112000		Empirical bonding and structure theories (Includes valence, bond and molecular orbital theories.)
13120000		# Scattering and transmission of isolated molecules
13121000		Scattering theory (Includes classical and relativistic theory of rainbow, glory and orbiting phenomena.)
13122000		Molecular beam scattering (Includes neutral and ion beams, electron impact.)
13123000		Photoionization and photodetachment
13130000		# Molecular spectroscopy and light scattering
13131000		Luminescence (Includes flourescence, phosphorescence, lifetimes, spectral intensities.)
13132000		Fine and hyperfine structure analysis (Includes infra-red, ultraviolet, visible and Raman spectroscopy.)
13133000		Coherent effects and resonance spectroscopy (Includes spin-couplings, lasers.)
13134000		Bulk electric and magnetic moments (Includes dielectric constants, refractive indices, optical rotation.)
13140000		# Thermodynamics
13141000		Thermochemistry (calorimetry)
13142000		Free energy and entropy calculation (via cyclical processes)

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Thermodynamics (continued)

13143000	Phase equilibria and colligative properties (Includes boiling and melting points, vapor pressure, phase diagrams, osmosis, solubilities.)
13144000	Irreversible thermodynamics (non-cyclical processes)
13150000	# Electrochemistry
13151000	Conductance and ionic reactions (Includes Faraday's laws, conductivity, ionization theory, transport numbers, ionic strength and activity coefficients.)
13152000	Electro-chemical cells (Includes cell electromotive force (EMF) measurement, electrolytic cells, galvanic cells, polarography, Nernst equation.)
13160000	# Kinetics (reaction mechanisms)
13161000	Reaction rate determination and analysis of mechanisms (Includes reaction order and molecularity, rate constants, kinetic relaxation theory, steady state theory, chain reactions.)
13162000	Reaction rate theory (Includes collision theory, transition state theory, isotope effects, homogeneous catalysis, rate inhibition.)
13163000	Energy transfer mechanisms (Includes photorelaxation, intersystem crossing, quenching, photo-sensitization.)
13164000	Photochemistry and photochemical reactions (Includes actinometry, flash photolysis, primary and secondary processes.) (See also Molecular spectroscopy and light scattering.)
13170000	# Surface chemistry
13171000	Chemical and physical adsorption (Includes contact catalysis, competitive adsorption, Langmuir adsorption isotherm. Brunauer-Emmett-Teller (BET) equation.)

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Surface chemistry (continued)

13172000 Surface tension and monolayers (Includes Gibbs adsorption isotherm and surface balance.)

13180000 # Macromolecules (only the physical chemistry aspects of macromolecules)

13181000 Molecular weight determination theory (Includes osmosis techniques, Donnan effect, Rayleigh effect, ultracentrifuge, viscosity theory.)

13182000 Configuration and physical properties (Includes elasticity, crystallinity as they determine chemical behavior.)

13190000 # Radiochemistry

13191000 # Hot atom chemistry (Includes isotope separation, recoil effects, radiolysis, chemical dosimetry.)

13192000 # Tracers (Also includes use of Geiger counters, scintillation counters, autoradiography, isotope exchange and isotopic dilution analysis.)

13193000 # Gamma-ray spectroscopy

13210000 # Kinetic theory of gasses (Includes Charle's, Boyle's and Van der Waal's equations, mean free path, gas viscosity, Avagadro's number, molecular effusion.)

13300000 Properties and electronic structure of elements

13310000 Properties of elements (Includes chemical and physical properties of the elements and their isotopes by the vertical groups of the periodic table, individual common light elements and heavier elements of specialized interest.)

13311000 # Properties of oxygen

13312000 # Properties of hydrogen

13313000 # Properties of nitrogen

13314000 # Properties of the inert gases (Includes helium, neon, krypton, argon, xenon, radon.)

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Properties of elements (continued)

13315000	# Properties of the halogens (Includes flourine, chlorine, bromine, iodine, astatine.)
13316000	# Properties of sulfur, selenium, tellurium, polonium
13317000	# Properties of phosphorus, arsenic, antimony, bismuth
13318000	# Properties of carbon
13319000	# Properties of silicon, germanium
13321000	# Properties of tin
13322000	# Properties of lead
13323000	# Properties of the alkali metals (Includes lithium, potassium, sodium, rubidium, cesium, francium.)
13324000	# Properties of the alkaline earth metals (Includes calcium, magnesium, beryllium, strontium, barium, radium.
13325000	# Properties of aluminum
13326000	# Properties of boron
13327000	# Properties of gallium, indium, thallium
13328000	# Properties of scandium, yttrium
13329000	# Properties of vanadium, niobium, tantalum
13331000	# Properties of chromium, molybdenum, tungsten
13332000	# Properties of iron, cobalt, nickel
13333000	# Properties of platinum, osmium, irridium, ruthenium, rhodium, palladium
13334000	# Properties of copper, silver, gold
13335000	# Properties of zinc, cadmium, mercury
13336000	# Properties of titanium, zirconium, hafnium
13337000	# Properties of manganese, technetium, rhenium

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Properties of elements (continued)

13338000 # Properties of the lanthanide series (Includes 15 elements.)

13339000 # Properties of the actinide series (Includes 15 elements.)

13340000 Electronic structure of elements and their isotopes (Includes quantum mechanics at the elemental level and electronic basis of spectral and chemical properties of elements.) (See also Molecular quantum mechanics, Molecular spectroscopy and light scattering, Radiochemistry.)

13400000 Molecular structure (See also Molecular quantum mechanics, Molecular spectroscopy, Molecular diffraction.)

13410000 # Chemical bonding (Includes electronic formulas, resonance theory, molecular orbital theory, coordinate covalent bonding, ligand field theory, and structure determination using spectral theory.)

13420000 # Stereochemistry (structure of organic and inorganic compounds; the 3-dimensional spatial arrangement of atoms in a molecule) (Includes geometrical and optical isomerism, point groups, optical rotatory dispersion, circular dichroism, microwave spectroscopy.) (See also Molecular spectroscopy and Macromolecules under Physical chemistry.)

13500000 Properties of classes of compounds (For nutritional qualities of compounds see Nutrition and dietetics in BIOLOGICAL SCIENCES; for pharmacological properties see Pharmacology in BIOLOGICAL SCIENCES.)

13510000 # Inorganic acids

13520000 # Inorganic bases

13530000 # Inorganic salts

13540000 # Complexes of heavy metal ions (coordination compounds)

13550000 # Alkanes (saturated hydrocarbons)

13560000 # Unsaturated hydrocarbons (Includes alkenes and alkynes.)

13570000 # Organometallic compounds (Includes mercurochrome, merthiolate, Grignard reagent.)

13580000 # Organic sulphur compounds (Refers to organic sulphur compounds other than sulphur limido.)

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Properties of classes of compounds (continued)

13590000	# Aromatic hydrocarbons (Includes benzene, its homologues and their derivatives.) (Note that this category excludes the amines and organometallic compounds.)
13610000	# Organic heterocyclic ring compounds (Includes furan and derivatives, pyrrole and derivatives, indole and derivatives, thiazole and derivatives (including penicillins), pyran and derivatives, pyridine and derivatives, pyrimidine and derivatives, and purines except when they are biochemical, e.g., vitamins, proteins, nucleic acids, or alkaloids.)
13620000	# Alkaloids
13630000	# Aliphatic alcohols
13640000	# Aromatic alcohols (Includes phenols and cresols but excludes sterols.)
13650000	# Aldehydes and ketones and derivatives (Note that this category excludes the aromatic aldehydes/ketones and the polyhydroxy aldehydes/ketones and carbohydrates.)
13660000	# Carboxylic acids, salts, esters and amides of carboxylic acids (Note that this category excludes amino and fatty acids.)
13670000	# Amines and derivatives (Includes analine and derivatives, phenacetin.) (Note that this category excludes the sulfanimides.)
13680000	# Sulfanimides
13690000	# Ethers (Note that this category excludes heterocyclic and aromatic ethers.)
13710000	# Halides (Includes carbon tetrachlorides, choloroform, "Freon", other than aromatic and heterocyclic halides.)
13720000	# Peroxides
13730000	# Quinones
13740000	# "Sandwich" (ferrocene-like) compounds and cage compounds

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Properties of classes compounds (continued)

13750000	# Carbohydrates (Includes monosaccharides (simple sugars) and their derivatives, oligosaccharides, disaccharides such as cane sugar and lactose, polysaccharides such as starch.)
13760000	# Proteins and related compounds
13761000	Amino acids
13762000	Oligopeptides
13763000	Polypeptides (Includes synthetic and biological polypeptides.)
13770000	# Nucleic acids
13771000	Nucleosides and nucleotides (Includes oligonucleotides, polynucleotides.)
13772000	DNA (deoxyribonucleic acid) and RNA (ribonucleic acid) (Note that this category excludes replication.)
13780000	# Lipids
13781000	Fatty acids (saturated and unsaturated)
13782000	Fatty acid esters (Includes oils, fats.)
13783000	Fatty acid salts (Includes soaps.)
13784000	Phospholipids, sphingolipids, cerebrosides
13790000	# Steroids (Includes cholesterol and adreno-cortical hormones, sex hormones.)
13810000	# Vitamins and other co-factors
13900000	Biochemical processes and mechanisms
13910000	# Photosynthesis (Includes chlorophyls and related pigments.)
13920000	Intermediary metabolism (small molecules)
13921000	# Biosynthesis (anabolism) and biodegradation (catabolism)
13921100	Biosynthesis and biodegradation of sugars

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	Biosynthesis and biodegradation (continued)
13921200	Biosynthesis and biodegradation of amino acids
13921300	Biosynthesis and biodegradation of fatty acids
13921400	Biosynthesis and biodegradation of purines, pyrimidines, nucleotides, and nucleosides
13921500	Biosynthesis and biodegradation of steroids
13922000	# Krebs cycle
13923000	# Glycolysis and fermentation
13924000	# Electron transport chain
13930000	# Biosynthesis and degradation of macromolecules
13931000	# DNA and RNA replication
13932000	# Proteins
13933000	# Carbohydrates
13934000	# Lipids
13935000	# Membranes
13936000	# Bacterial and plant cell walls
13940000	# Control mechanisms of biochemical processes (Includes feedback, inhibition and activation, repression and induction of enzyme synthesis, allosteric interaction.)
13950000	# Mechanisms of enzyme activity (Includes enzyme kinetics, binding of small molecules, catalytic mechanism.)
14100000	Applied chemistry
14110000	Heterogeneous matter (solutions and colloids)

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Heterogeneous matter (continued)

14111000 SS # Solutions (mechanical, optical, colligative properties; dilute, normal, molar, saturated and supersaturated solutions, whether liquid, solid or gaseous phase) (For analytical tests relying upon one or more of these properties see Chemical analysis and preparation of samples.) (See also Phase equilibria and colligative properties in Thermodynamics.)

14112000 # Colloids (one type of matter dispersed through another type of matter in units larger than molecules) (Includes those alloys which are not solutions.)

14112100 Hydrosols (solids, gasses or liquids in liquids, such as, suspensions, emulsions, foams, lathers, froths)

14112200 Solid dispersals (liquids, gasses or solids dispersed through solids, such as, alloys, gels, solid foams)

14112300 Aerosols (solids or liquids in gasses, such as, smokes, fogs, mists)

14120000 SS Chemical analysis and preparation of samples (See also Empirical bonding and structure theories and MATERIALS.)

14121000 SS # Mechanical analysis (tests of mechanical properties of matter) (Includes gravimetrics, weight and specific gravity, strength, hardness, brittleness, ductility; microscopic analysis of physical properties.) (See also Descriptive physics for physical knowledge of properties.)

14122000 # Thermal analysis (measuring differences in temperature in different parts of a sample or with passing of time) (Includes thermal titrometry, thermal tests, differential thermal tests.) (See also Heat flow in PHYSICS.)

14123000 # Electrical analysis and electrodeposition (analytic methods involving electric current or potential (voltage) condition in relation to sample condition) (See also Electric circuit theory, Solid state physics.)

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Chemical analysis and preparation of samples (continued)

14124000	# Radiochemical analysis (use of radioactive isotopes as tracers in reactions; also, use of radiation as reaction activators) (See also Radiochemistry, Kinetics, Properties and electronic structure of elements, Nuclear structure, Radionuclide analysis.)
14125000	# Optical analysis (Includes photometric, refractometric, interferometric, polarimetric and spectometric methods.) (For knowledge of the physical properties measured in these tests see Optical properties in PHYSICS.) (See also Molecular spectroscopy and light scattering, Kinetics, Optics, Solid state physics.)
14126000	# Neutralization and oxidation/reduction methods
14127000	# Volumetric analysis (determination by titration with standard solutions and indicators)
14128000 SS	# Separation methods in analysis (Includes selective absorption, distillation and evaporation, extraction by solvents, separation by ion exchange, chromatography and diffusion analysis, precipitation methods.) (See also Electrometric methods, Colloids, Solutions, Electrical analysis and electrodeposition, Surface chemistry, Kinetic theory of gasses, Fluid dynamics, and Statistical physics.)
14200000	# History of chemistry*

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15000000	PHYSICS (For the mathematical knowledge used, see MATHEMATICS AND RELATED DISCIPLINES.)
15100000	# History of physics*
15200000	Theoretical physics (study of physics in terms of models)
15210000	Classical subjects
15211000	Classical mechanics (forces acting on objects and the motions produced thereby)
15211100	# Statics (study of balanced forces producing no motion in the bodies on which they act) (Includes loads, stress and strain, virtual work, equilibrium under forces.)
15211200	# Dynamics of rigid bodies (operation of forces in producing or changing the motion of bodies) (Includes friction, action of levers, velocity, acceleration, momentum, work, energy, angular momentum-flywheel, rotation-torque, precession-gyroscopic principle, harmonic motion-pendulum.)
15211300	# Gravitation (Includes Newton's law, mass, weight in proportion to the acceleration of gravity, weightlessness in orbit, planetary orbits, trajectory of a projectile.)
15212000	Parametrized dynamics
15212100	# Electric circuit theory (Includes Ohm's law, Kirchhoff's laws, impedance, inductance, resistance, amperage, voltage, potentiometry, bridges, alternating and direct current, wave-guides, transmission.)
15212200	# Lagrange-Hamilton theory (Includes Euler's angles, Lagrange equations, Hamilton's equations, variational principles, canonical transformations.)
15213000	Classical field theory (involves fields, which are properties (e.g. temperature, magnetic attraction, viscosity) which exist everywhere within a continuous volume of space)

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	Classical field theory (continued)
15213100	# Electrical and magnetic fields (Includes electrostatic charge, Coulomb's law, energy in an electromagnetic field, forces on a charge distribution, forces on a current distribution, permanent magnets, magnetic field due to electric currents, Maxwell's field equations.)
15213200	# Plasma physics (Includes electrical neutrality in a plasma, particle orbits and drift motion in a plasma, magnetic mirrors, hydromagnetic equations, pinch effect, plasma oscillations and wave motion.)
15213300	# Special relativity (Includes mass increase, time dilation, length contraction, bending of light near a massive body, gravity waves.)
15213400	# General relativity
15213500	# Fluid dynamics (Includes hydrodynamics, viscosity, irrotational flow, turbulence.) (For super fluids see also Quantum mechanics.)
15213600	# Heat flow (Includes heat conductivity, convection, radiative transfer, Fourier's theory of heat.)
15214000	Classical wave theory
15214100	# Acoustics (Includes sound, compression waves, sound propagation, Doppler effect.)
15214200	# Optics (Includes electromagnetic radiation, spectra, infrared, light, ultraviolet, x-ray radiation, polarization of light, reflection and refraction, black-body radiation, lasers, radiation from an oscillating charge distribution.)
15214300	# Radio waves
15214400	# Surface waves (Includes water ripples.)

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Theoretical physics (continued)

15220000	Modern subjects
15221000	Quantum mechanics (modern study of energy, especially as emitted in radiation) (See also Optics.)
15221100	# Potential theory (Includes energy levels in a potential well, central-force problems, particle waves, Schroedinger wave equations, atomic wave functions, ordinary quantum mechanics of single or several particles.)
15221200	# Axiomatic field theory
15221300	# Quantum electrodynamics (Includes Feynman diagrams, radiative corrections, renormalization.)
15221400	# Current and source theories (Includes current algebra-Gell-Mann, field-current identities-Lec, phenomenological sources-Schwinger.)
15222000	Atomic theory (the physics of atoms) (For molecular physics and structure of elements see Physical chemistry.)
15222100	# Atomic structure (Includes nuclear atom model, electronic energy levels, magnetic spin-orbit interaction.)
15222200	# Atomic radiation processes (Includes ionization potentials, line spectra-transitions between electronic energy levels, forbidden lines, Zeeman effect, Stark effect, band structure-rotational spectra.)
15222300	# Heavy-atom levels (Includes muonic atoms, kaonic atoms.)
15222400	# Fine structure and hyperfine structure (Includes atomic line spectra.)
15222500	# Interaction with radiation (Includes inversion spectra-absorption of microwave radiation.)

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Modern subjects (continued)

15223000 Nuclear theory (the physics of the nuclei of atoms)

15223100 # Nuclear structure (Includes composition, binding energies, energies of excited states, saturation of internucleon forces, charge independence of nuclear forces, isotopic spin, instability of nuclear states, exchange forces, nuclear moments, shell model, L-S coupling model, independent particle model, collective model, mass defects, periodicity of stable islands.)

15223200 # Nuclear reactions (Includes stripping reactions, fission, fusion alpha decays, beta decays, x-ray emission, internal conversion, optical model, liquid drop model, statistical model, compound nuclear model, neutron moderation; also includes scattering processes such as elastic and inelastic scattering, resonance processes, muon and neutrino capture, photoproduction, star production.)

15224000 Particle theory (the physics of sub-atomic particles, some of which make up atoms and nuclei) (See also Nuclear reactions, Atomic structure.)

15224100 # Weak interactions (Includes beta decay.)

15224200 # Symmetries and conservation laws (Includes group theory, SU3.)

15224300 # Scattering matrix theory (Includes dispersion relations, Regge trajectories, analytic crossing symmetry.)

15230000 Statistical physics (statistical mechanics) (For the statistics involved see Statistics.)

15231000 # Equilibrium (study of effects and properties of a multitude of particles taken as a whole) (Includes Gibb's ensemble, partition function, fluctuations, Maxwell velocity distribution, mean free path, kinetic theory of gases.)

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	Statistical physics (continued)
15232000	# Transport (gross) (Includes statistical theory of viscosity, electric conductivity, thermal conductivity.) (See also ENGINEERING AND TECHNOLOGY.)
15233000	# Particle and quasi-particle behavior (Includes BCS theory of super-conductivity, phonons, excitons.)
15234000	# Liquid and solid state application (Includes defects, solution activities.)
15240000	Solid state physics (For technological applications, see ENGINEERING AND TECHNOLOGY.)
15241000	# Crystallography and x-ray diffraction
15242000	# Free electron theory of metals (Includes conductivity.)
15243000	# Energy-band theory of solids (Includes allowed electronic energy levels, effectively formed bands, wide gap between bands--insulator, narrow gap--semi-conductor.)
15244000	# Ionic crystals (Includes dielectric constant, electronic energy levels, lattice imperfections, ionic conductivity, photographic emulsions.)
15245000	# Flow of electrons and holes in semiconductors
15246000	# Photoelectric effect (changes in the electrical characteristics of a material exposed to light)
15247000	# Thermionic emission (emission of charged particles from a heated surface)
15248000	# Phase transitions in solids
15300000	Applied physics
15310000	Macroscopic matter
15311000	# Mechanical properties (Includes coefficient of friction, strength, hardness, elasticity.) (See also ENGINEERING AND TECHNOLOGY.)

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Macroscopic matter (continued)

15312000	# Thermal properties (Includes specific heat, coefficient of expansion, thermoelectric effect, dependence of resistance on temperature, heat transfer, heat refraction, radiation, absorption.) (See also Equilibrium and Transport of Statistical physics.)
15313000	# Electrical properties (Includes conductivity, dielectric constant, piezoelectricity, ferroelectricity, electrolytic conductivity, Hall effect.) (See also Electrical and magnetic fields, ENGINEERING AND TECHNOLOGY.)
15314000	# Magnetic properties (Includes permeability, diamagnetism, paramagnetism, permanent magnetization, Curie or Neelpoint, hysteresis.) (See also Electrical and magnetic fields, ENGINEERING AND TECHNOLOGY.)
15315000	# Optical properties (Includes transparency, index of refraction, prism action, filters, double refraction, dispersion, absorptive edges, flourescence, phosphorescence; geometrical optics(ray tracing),Snell's law, image formation, focal points, correction of an optical system.) (See also Optics of Classical wave theory and Interaction with radiation.)
15320000	Submicroscopic matter
15321000	# Atomic lattice structure (Includes Bragg angles, lattice symmetries, internuclear distances.) (See also Solid state physics.)
15322000	# Particle acceleration (Includes Cockcraft-Walton, Van de Graaf, betatron, cyclotron, linear accelerator, strong focusing accelerator.)
15323000	# Strange particle production and decays (Includes masses, lifetimes, decay parameters, symmetries, symmetry breaking mechanisms.) (See also Weak interactions and Symmetries of Particle theory.)
15324000	# Resonances (strong interactions) (Includes production mechanisms, symmetries, cross-sections.) (See also Symmetries and Scattering matrix theory of Particle theory.)

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NATURAL SCIENCES (continued)

16000000 ASTRONOMY AND ASTROPHYSICS

16100000 # History of astronomy*

16200000 # Observational astronomy (knowledge directly inferred from observation)*

16300000 # Theoretical astronomy and astrophysics*

17000000 GEOSCIENCES (The categories listed below refer to knowledge specific to the geosciences.) (For knowledge of the physics, chemistry, biology, mathematics, engineering, etc. involved with knowledge of some of the categories listed under GEOSCIENCES, see appropriate categories listed under NATURAL SCIENCES, MATHEMATICS AND RELATED DISCIPLINES, ENGINEERING AND TECHNOLOGY.)

17100000 # Astrogeology (planetary geology)*

17200000 Geography (geographic conditions, events and distributions) (For study of the physical processes involved see Atmospheric science, Water sciences, Land structure and processes.) (For Human geography see appropriate categories in SOCIAL SCIENCES.)

17210000 # History of geography*

17220000 # Physical geography (geographic conditions, distributions and their history)*

17300000 Cartography, navigation and geodesy (For topography see also Geomorphology; for uses of mathematics in the categories listed below see MATHEMATICS AND RELATED DISCIPLINES; for marine (underwater) cartography see Bathymetry under Water sciences.)

17310000 # History of navigation

17320000 # History of cartography

17330000 # Navigation systems (Includes traditional navigation, astronomic position fixing, satellite position fixing.)

17340000 # Cartography (maps and globes) (Includes projections, scale mapping, relief mapping, contour mapping.)

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	Cartography, navigation and geodesy (continued)
17350000	# Geodesy (mathematical expression of size and shape of the earth and its external gravitational field) (See also MATHEMATICS.)
17400000	Atmospheric science (Covers the traditional sciences of meteorology, aeronomy, and marine meteorology.)
17410000	# History of atmospheric science*
17420000	Atmospheric composition and structure
17421000	# Astrochemistry (chemistry of the atmosphere) (See also CHEMISTRY.)*
17422000	# Coniology (Includes ocean salt spray particles, desert and soil erosion dust, volcanic ash and industrial dust.)
17423000	# Atmospheric (air) pollution (physical causes)*
17424000	# Atmospheric temperature (Includes temperature variation in latitude and altitude, "greenhouse" effects.)
17425000	# Atmospheric pressure (Includes pressure variation with altitude and latitude.)
17426000	# Atmospheric circulation (Includes wind patterns and air masses both of the troposphere and stratosphere, atmospheric tides, regional and local winds such as monsoons, cyclones, hurricanes, typhoons, tornadoes.)
17427000	# Atmospheric electricity (Includes electricity of the troposphere, stratosphere and ionosphere, aurora and airglows.)
17428000	# Atmospheric moisture (Includes nucleation, condensation, rain, snow, hail, fog.)
17429000	# Atmospheric dimensions (structure of the atmosphere) (Includes troposphere, stratosphere, mesosphere, thermosphere, ionosphere, exosphere, magnetosphere.)
17430000	# Climatology (climate, climatic change) (Includes aperiodic variations, cycles and periodicities of climate; climatic effects of ice ages; climatic feedback processes.)*

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GEOSCIENCES (continued)

17500000	Water sciences (oceanography and hydrology; salt and fresh water) (Marine biology would appear in the BIOLOGICAL SCIENCES if categories were broken out to greater detail.)
17510000	# History of oceanography*
17520000	# History of hydrology*
17530000	# Bathymetry (Includes marine (underwater) cartography, submarine geomorphology.)*
17540000	# Chemical oceanography* (See also CHEMISTRY.)
17550000	# Fresh water geochemistry* (See also CHEMISTRY.)
17560000	# Water characteristics (Includes water density and temperature, optical and acoustical characteristics) (See also Optical properties, Acoustics, Fluid dynamics, Thermal properties.)
17570000	# Water masses (Includes water convergence, divergence, upwelling.)
17580000	# Currents, waves and tides (Includes geostrophic, littoral, near-shore and tidal currents; wave theory, measurement, energy, and translation; lunar, solar, or planetary induced tides.)
17590000	# Water distribution (Includes runoff and soil percolation to streams, percolation to groundwater, spring outflow, water storage, dissolved material in water, bed load, saltation.)
17600000	# Minerology*
17700000	# Geochemistry (Note that this category excludes chemical oceanography, astrochemistry and fresh water geochemistry.)*
17800000	Land structure and processes (Includes marine geology.)
17810000	# Petrology and sedimentology (description and interpretation of the origin, formation and structure of rocks)
17811000	# History of petrology

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Petrology and sedimentology (continued)

17812000 # History of sedimentology

17813000 # Igneous processes and igneous rocks (Includes those aspects of petrogenesis relating to igneous rocks.)

17814000 # Metamorphism and metamorphic rocks (Includes those aspects of petrogenesis relating to metamorphic rocks.)

17815000 # Sedimentation and sedimentary rocks (Includes sedimentary accumulation and structures, sedimentary vulcanism, diagenesis, lithification.)

17820000 # Stratigraphy (origin, composition, distribution and succession of strata)

17821000 # History of stratigraphy

17822000 # Historical geology (geologic time) (Includes such geologic periods as Cenezoic, Mesozoic, Paleozoic, Precambrian.)

17823000 # Correlation and relative chronology (Includes diastrophic correlation, bio-stratigraphy, ephrachronology, ash layers.)

17824000 # Absolute chronology (Includes radiocarbon dating, U/PG, K/A, RB/SR dating.) (See also CHEMISTRY.)

17825000 # Paleontology (fossil remains of animals and their relation to past geologic periods) (Includes history of paleontology, fossilization, paleoclimatology, paleontologic systematics, paleozoology, paleogeography, paleobotany, human paleontology, paleoecology.)* (See also BIOLOGICAL SCIENCES.)

17830000 # Tectonics (structural geology) and geotectonics (For strength of geological materials see ENGINEERING AND TECHNOLOGY.)

17831000 # History of tectonics and geotectonics

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Tectonics and geotectonics (continued)

17832000	# Tectonical structure (micro level) (Includes jointing and cleavage, faulting, folding, crustal warping, diapirism, plutonism, diatremes, monocyclic deformation, polyphasic deformation, non-diastrophic primary structures.)
17833000	# Geotectonics (macro levels) (Includes diatrophism--that process of deformation which produces in the earth's crust its continents and ocean basins, plateaus and mountains, geosynclines.)
17834000	# Tectonic and geotectonic landforms (Includes uplift features, ridge and valley features, folded terrain, subsidence features, rifts, block-faulted terrain, fault terrain.)
17840000	# Geomorphology (Covers physiography and stages of geomorphic maturity.) (For knowledge of local or regional geographical conditions see Geography; for submarine geomorphology see Bathymetry.)
17841000	# Topography (terrestrial relief on a macro scale) (Includes first order relief (hypsographic curve), second order relief, third order relief (hypsometry) and microrelief (terrain texture), triangulation, levelling, cadastral, geologic and topographic surveys.)
17842000	Landforms (Note that the categories listed below refer mainly to surface features in the earth's crust and to the processes by which they are formed, primarily from such surface effects as wind and water force.) (Excludes those processes covered in Tectonics and geotectonics.)
17842100	# Volcanic and igneous landforms (Includes central volcanoes, ash phenomena, cryptovolcanic features, subglacial volcanic phenomena, plutonic and hypabyssal erosion phenomena.)
17842200	# Mass wasting (Includes landslides, land slumping, land creep.)

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					Landorms (continued)			
17842300						# Fluvial features of landforms (Includes drainage features, watershed, waterfalls, stream channels.)		
17842400						# Karstic phenomena and speleology (caves and related phenomena)		
17842500						# Suffusion and leaching phenomena (Includes collapse features, periglacial suffusion, mound springs, sand boils, mud lumps.)		
17842600						# Glaciology, fluvio-glacial processes and cryogenics (Includes ice dynamics, snow diagenesis, nivation, cirque, mountain and continental glaciation, outwash, sandur, esker, kame phenomena, frost action, pipkrake, freeze and thaw, permafrost, rock glaciers, altiplanation, proglacial ramparts.)		
17842700						# Eolian phenomena (eolization) (Includes wind polish, airborne dust phenomena, windscoured features, ablation, deflation hollows, loess, dunes.)		
17842800						# Lakes, geomorphic limnology (Includes tectonic lakes, volcanogenic lakes, glacial lakes, solution lakes, fluviatile lakes, littoral lakes, eolian generated lakes, organic dammed lakes, landslide dammed lakes, meteorite crater lakes.)		
17842900						# Plains and planation processes (Includes erosional plains such as marine abrasion platforms, peneplains, pedeplains, etchplains, cuesta landscapes, and accumulative plains such as sediplains.)		
17843000					# Paleogeomorphology (Includes buried landscape, paleosols, buried submarine topography, stripped landscape, inherited features.)*			
17844000					# Organic geomorphology (Includes botanic, zoologic agencies.) (See also BIOLOGICAL SCIENCES.)			
17900000			# Geophysics (Includes seismology, wave propagation, gravity, geomagnetism, radioactivity, earth tides and rotation, tectonophysics, geothermometry, marine geophysics.)*					
18100000			# Pedology (soil science) (See also Soil mechanics.)*					

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20000000 SS	ENGINEERING AND TECHNOLOGY (See also PHYSICS, CHEMISTRY and MATHEMATICS AND RELATED DISCIPLINES.)
21000000	CONTINUUM MECHANICS
21100000	# Stress, strain and related phenomena (Includes stress, strain, strain rate, constitutive relations, strain displacement relations.)
21200000	Fluid mechanics
21210000	# Momentum transport (engineering systems whose principle of action depends upon conservation of momentum)
21211000	Fundamental momentum transport (Includes compressible and incompressible flow, Newtonian and non-Newtonian flow, boundary layer and potential flow.)
21211100	# Transport by molecular motion (viscosity)
21211200	# Momemtum transport in laminar flow (Includes creeping flow.)
21211300	# Momentum transport in turbulent flow
21211400	# Momentum transport between phases
21211500	# Macroscopic momentum transport (macroscopic balances)
21211600	# Momentum transport in magnetohydrodynamic flows
21211700	# Momentum transport in waves (Includes shock waves.)
21212000	Applied momentum transport
21212100	# Piping systems
21212200	# Fluid meter systems
21212300	# Agitation and mixing (Includes liquid-liquid, gas-liquid, solid-liquid, solid-solid systems.)
21212400	# Pump systems
21212500	# Fan, blower, and compressor systems

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	Applied momentum transport (continued)
21212600	Phase separations based on fluid mechanics
21212610	# Settling systems
21212620	# Centrifuging systems
21212630	# Cyclone systems
21212640	# Filtration systems
21212700	# Fluidization systems
21212800	# Pneumatic transport systems
21212900	# Wing theory (Includes airfoils, lift bodies.)
21213100	# Propeller theory
21213200	# Rocket and jet propulsion systems
21213300	# Ship design theory (Includes hull design, undersea vehicle hull design, but excludes other aspects of ship design.)
21213400	# Surface waves
21213500	# Wind tunnels and towing tanks
21213600	# Shock wave structure
21213700	# Lubrication-bearing design (Includes the study of lubrication bearings.)
21213800	# Magnetohydrodynamic propulsion and pumping systems
21213900	# Hydraulic and pneumatic control systems
21220000	# Energy transport (engineering systems whose principle of action depends upon conservation of energy)
21221000	Fundamental energy transport
21221100	# Transport by molecular motion (thermal conductivity)
21221200	# Energy transport in laminar flow (Includes creeping flow.)

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Fundamental energy transport (continued)

21221300	# Energy transport in turbulent flow
21221400	# Energy transport between phases
21221500	# Energy transport by radiation
21221600	# Macroscopic energy transport (macroscopic balances)
21221700	# Energy transport in magnetohydrodynamic flows
21221800	# Energy transport in waves (Includes shock waves.)
21222000	Applied energy transport
21222100	# Heat exchange, furnace systems, steam power plants
21222200	# Magnetohydrodynamic power generation systems
21230000	# Mass transport (engineering systems whose principle of action depends upon conservation of mass)
21231000	Fundamental mass transport
21231100	# Transport by molecular motion (diffusivity)
21231200	# Mass transport in laminar flow (Includes creeping flow.)
21231300	# Mass transport in turbulent flow
21231400	# Mass transport between phases
21231500	# Macroscopic mass transport (macroscopic balances)
21231600	# Mass transport in magnetohydrodynamic flows
21231700	# Mass transport in waves (Includes shock waves.)

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	Mass transport (engineering systems whose principle of action depends upon conservation of mass) (continued)
21232000	Applied mass transport or combined transport mechanisms
21232100	# Absorption and desorption systems
21232200	# Adsorption systems
21232300	# Ion exchange systems
21232400	# Chromatography systems
21232500	# Extraction and leaching systems
21232600	# Distillation systems
21232700	# Humidification and de-humidification systems
21232800	# Drying systems
21232900	# Evaporation systems
21233100	# Crystallization systems
21233200	# Electrorefining and electrowinning
21300000	Solid mechanics (See also GEOSCIENCES wherever applicable.)
21310000	# Elastic continuum
21311000	Fundamental elastic continuum
21311100	Statics (analysis of a body or system of bodies in a state of equilibrium)
21311110	# Conservation of mass, momentum, energy
21311120	# Virtual work
21311130	# Buckling
21311140	# Bending, torsion, warping
21311150	# Reliability analysis
21311160	# Instability
21311170	# Thermoelasticity

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	Fundamental elastic continuum (continued)
21311200	Dynamics (the motion of systems of particles under the influence of forces)
21311210	# Vibrations
21311220	# Wave and wave propagation in an elastic continuum
21312000	Applied elastic continuum
21312100	# Mechanics of solids (Includes stress and strain analysis.)
21312200	# Plates and shells (deformation of objects whose thickness is small compared to their other dimensions)
21312300	# Analysis of statically determinate and indeterminate trusses and frames (Includes force method, displacement method, matrix method, energy method, moment distribution, slope deflection, moment area, conjugate beam.)
21312400	# Beams (Includes straight beams, continuous beams, composite beams, curved beams.)
21312500	# Columns (Includes beam columns.)
21312600	# Connections (Includes beam to beam connections, beam to column, plate connection, riveting and welding of structural members.)
21312700	# Structural steel design theory (See also MATERIALS.)
21312800	# Concrete design theory (Includes reinforced concrete design, prestressed concrete design, post-tensioned concrete design.) (See also MATERIALS.)
21312900	# Wood design theory (use of wood as a construction material) (See also MATERIALS.)

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Solid mechanics (continued)

21320000	# Inelastic continuum
21321000	Fundamental inelastic continuum
21321100	# Theory of viscoelasticity (theory of the load-deflection response of materials when time is considered as a dependent parameter) (Includes internal friction, damping, anelasticity, elastic aftereffect, stress relaxation.)
21321200	# Theory of plasticity (formulation of the permanent deformation of materials) (Includes yield criteria, work hardening, visco-plastic effects.)
21322000	Applied inelastic continuum
21322100	# Creep (time-dependent plastic flow of a material subjected to a constant load)
21322200	# Fatigue (failure of a material when subjected to many applications of the same load)
21322300	# Fracture mechanics (failure of materials due to plastic deformation)
21322400	# Limit analysis (structural failure based upon maximum safe load criteria)
21322500	# Soil mechanics (See also Pedology in the GEOSCIENCES.)
21322510	# Foundation design (Includes bearing capacity, settlement, structure-foundation interaction.)
21322520	# Retaining walls (Includes lateral pressure, bulkhead design, basement wall design.)
21322530	# Earth dams (Includes soil compaction, seepage control, caisson design, cofferdam design.)

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						Soil mechanics (continued)		
21322540							# Slope stability (Includes landslides, embankment design.)	
21322550							# Flow through a porous medium (Includes seepage, drainage, capillarity.) (See also Fundamental momentum transport.)	
21322600						# Rock mechanics (See also GEOSCIENCES.)		
21322610							# Rock characteristics	
21322620							# Stress analysis within the earth's crust	
21322630							# Surface excavations (Includes surface foundations, natural slopes, open pits, quarries.)	
21322640							# Underground openings (Includes tunnel construction, mine design, boreholes.)	
21322650							# Comminution (Includes drilling, blasting, crushing.)	
21322660							# Rock design (use of rock as a construction material) (See also MATERIALS.)	
21330000				# Rigid body mechanics (For the knowledge of physics involved see Dynamics of rigid bodies.)				
21331000					# Random processes in mechanics			
21332000					# Dynamics of high altitude rockets and artificial satellites			
21333000					# Earthquake response of structures			
21334000					# Motion and vibrations in machines (Includes motion of machine elements, balancing, vibration isolation, vehicle suspension.)			
21335000					# Dynamic response of machine elements (Includes inertia forces and stresses, shock, impact loading, gyroscopic motion.)			

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ENGINEERING AND TECHNOLOGY (continued)

22000000 ENGINEERING THERMODYNAMICS (See also Physical chemistry.)

22100000 Fundamental thermodynamics

22110000 # Thermodynamics of flow processes

22120000 # Thermodynamic analysis of processes

22200000 Applied thermodynamics

22210000 # Vapor power cycles (Includes Carnot cycle, Rankine cycle, reheat cycle, Stirling-engine, heat engine, steam engine cycles, heating systems.)

22220000 # Gas power cycles (Includes internal combustion engines, gasoline engine cycle, diesel engine cycle.)

22230000 # Refrigeration cycles (Includes air conditioning, refrigeration plants, cooling towers.)

22240000 # Reactive systems (Includes combustion, explosive pressure, chemically reactive systems.)

23000000 # ENGINEERING KINETICS (Includes chemical reactor design.) (See also Physical chemistry.)

24000000 ELECTRICAL ENGINEERING (See also PHYSICS, Classical field theory; Solid state physics and plasmas.)

24100000 Electrical science (physics-oriented aspects of electrical engineering)

24110000 # Electromagnetic field theory applications (Includes electromagnetic devices and energy conversion.)

24111000 # Magnetic circuits

24112000 # Transducers and rotating machines (Includes electric motors, electric generators, relays, solenoids.)

24113000 Electromagnetic radiation sources and transmission

24113100 # Microwaves and waveguides

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	Electromagnetic radiation sources and transmission (continued)
24113200	# Radio and telemetry
24113300	# Antennas
24120000	Applied acoustics (For acoustics of speech and music see LINGUISTICS.)
24121000	# Acoustic properties of materials (Includes impedance, absorption.)
24122000	# Measurement of sound and noise
24123000	# Noise and vibration
24124000	# Ultrasonics
24130000	# Electronics
24131000	# Physical electronics
24132000	Applied electronics
24132100	# Electronic devices
24132110	# Direct current (D.C.) and small signal models (Includes thermal, speed and noise limitation models.)
24132120	# Passive components (Includes impedances, both linear and non-linear.)
24132130	# Vacuum tubes
24132140	# Transistors
24132150	# Field effect transistors
24132160	# Conductors, insulators, semiconductors
24132170	# Opto-electronic devices (photoelectric devices)
24132200	# Technologies (monolithic, thin film, thick film)

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Applied electronics (continued)

24132300	# Circuits
24132310	# Linear small signal circuits (Includes amplifier circuits.)
24132320	# Pulse and digital circuits (Includes wave shaping, computer circuits.)
24132330	# Filters
24132340	# Large signal and communication circuits (Includes modulators.)
24200000	Systems theory (electrical) (For general systems theory see CYBERNETICS.)
24210000	# Network theory (electrical)
24211000	# Linear networks (Includes fundamental concepts such as node and loop equations, topological analysis, duality, time domain techniques, frequency domain techniques.) (For mathematical aspects see MATHEMATICS AND RELATED DISCIPLINES.)
24212000	# Non-linear and time varying networks
24213000	# Network synthesis and realizability
24214000	# Stability of systems
24215000	# Power systems
24220000	# Control systems (electrical) (For classical system design theory see Control theory in CYBERNETICS.)
24230000	Communication systems (electrical) (See also CYBERNETICS AND COMPUTER SCIENCES.)
24231000	# Signal theory
24232000	# Noise and random processes
24233000	# Modulation theory
24234000	# Estimation and defection

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Systems theory (continued)

24240000	# Automata theory (See also MATHEMATICS AND RELATED DISCIPLINES.)
24241000	# Switching theory
24241100	Combinational circuits
24241200	Sequential circuits (Includes synchronous machines, asynchronous machines.)
24242000	Formal systems (See also Mathematical logic.)
24242100	# Turing machines and computability
24242200	# Generators and grammars
24243000	Computer design
24243100	# Digital computer design logic (See also Switching theory.)
24243200	# Analog computer design
25000000	PROCESS, PLANT, AND MECHANICAL SYSTEMS
25100000	# Process simulation (setting up a model of a process to study the effects of parameter variations) (For statistical aspects see MATHEMATICS AND RELATED DISCIPLINES.)
25200000	# Process optimization (study of a process to determine the optimum method of design of operation) (For statistical aspects see MATHEMATICS AND RELATED DISCIPLINES.)
24300000	# Kinematics of machines (synthesis and analysis of the motion of machine elements, mechanism design)
25400000	# Gear design theory (Includes gear tooth design, gear trains, differential gear systems, standard automotive transmissions.)
25500000	# Casting (Includes foundry casting, mold design, injection casting, pattern design.)

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PROCESS, PLANT, AND MECHANICAL SYSTEMS (continued)

25600000 # Tools and dies (Includes design of tools to cut and shape material.)

25700000 # Fabrication selection (application of machine tools, cutting and joining of materials, material selection)

26000000 # RELIABILITY AND QUALITY CONTROL IN ENGINEERING PROCESSES (Includes nondestructive testing, acceptance testing.) (For mathematical or statistical aspects see MATHEMATICS AND RELATED DISCIPLINES.)*

27000000 AUTOMOTIVE TECHNOLOGY

27100000 # Automotive engines (See also Gas power cycles, Heat exchange systems, Reactive systems, Lubrication and bearing design.)

27200000 # Automotive transmissions and power systems (Includes automatic and standard transmissions, braking, power steering.) (See also Pump systems, Hydraulic and pneumatic control systems, Gear design, Lubrication-bearing design, Friction.)

27300000 # Automotive chassis (Includes suspension, steering.) (See also Vibrations in machines, Dynamic response of machine elements, Kinematics of machines.)

27400000 # Automotive electrical system (See also Electromagnetic devices and energy conversion, Circuits.)

28000000 AIRCRAFT TECHNOLOGY

28100000 # Airframes (See also Wing theory, Wind tunnels, Analysis of statically determinate and indeterminate trusses and frames, Beams, Columns, Connections, Thermoelasticity, Vibrations, Fatigue.)

28200000 # Propulsion (See also Propeller theory, Rocket and jet propulsion systems, Heat exchange, Gas power cycles, Lubrications and bearing design.)

28300000 # Power systems (See also Pump systems, Hydraulic and pneumatic control systems, Control systems, Fan, blower and compressor systems.)

28400000 # Electrical system (See also Electromagnetic field theory applications, Circuits, Electronics.)

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ENGINEERING AND TECHNOLOGY (continued)

29000000 BUILDING CONSTRUCTION TECHNOLOGY

29100000 # Excavation and foundation (See also Soil mechanics, Rock mechanics.)

29200000 # Structure (See also Analysis of statically determinate and indeterminate trusses and frames, Structural steel design, Beams, Columns, Concrete design, Wood design, Connections, Limit analysis, Earthquake response of structures, RELIABILITY AND QUALITY CONTROL IN ENGINEERING.)

29300000 # Surveying (See also Optical metrology, Geometry, Measure theory, Elementary functions and complex variables.)

31000000 # AIR CONDITIONING AND HEATING TECHNOLOGY (See also Fan, blower and compressor systems, Heat exchange and furnace systems, Vapor power cycles, Refrigeration cycles, Pneumatic control systems, Electromagnetic field theory, Chemical thermodynamics, Evaporation systems, Reactive systems.)

32000000 # ELECTRONICS TECHNOLOGY (Includes electronic systems such as radio and television.) (See also Applied electronics, Electromagnetic radiation sources and transmission, Microwaves and waveguides, Radio and telemetry, Antennas, Electromagnetic field theory applications.)

33000000 # COMPUTER TECHNOLOGY (See also Computer design, Electronics.)

34000000 # AUDIO (SOUND EQUIPMENT) TECHNOLOGY (See also Applied acoustics, Electronics technology.)

35000000 # AGRICULTURAL TECHNOLOGY (Includes methods of cultivation and agricultural equipment.)*

36000000 SS MATERIALS (Includes those aspects of materials related to their application in productive processes.)

36100000 Wood and wood products

36110000 # Lumber (Includes mahogany, oak, walnut, spruce, pine, ash.)

36120000 # Gums and barks

36130000 # Wood pulp and paper

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MATERIALS (continued)

36200000	Metals
36210000	# Metal ores (Includes ferrous metal ores and non-ferrous metal ores in their natural state or in their use in the creation of processed metals.)
36220000	# Processed metals (Includes ferrous and non-ferrous processed metals as raw materials or as fabricated products.)
36300000	# Coal (Includes anthracite, bituminous, lignite and tars.)
36400000	# Crude petroleum
36500000	# Natural gases
36600000	# Oils
36700000	# Soaps, detergents and cleaning preparations
36800000	# Stone, marble and gems
36900000	# Sand and gravel
37100000	# Concrete, gypsum and plaster
37200000	# Clay (Includes ceramic and earth substances.)
37300000	# Natural and chemical fertilizer substances
37400000	# Glass
37500000	# Cordage, twine, thread and fibers (Includes fibers in their use in creating cordage, thread and twine and threads in their use in creating fabrics.)
37600000	# Fabrics (cloth)
37700000	# Plastics
37800000	# Rubber (Includes natural and synthetic rubber.)
37900000	# Dyes and pigments
38100000	# Paints, varnishes, lacquers and shellac
38200000	# Leather and suede
38300000	# Furs and hairs

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40000000	SOCIAL SCIENCES							
41000000	SS	BEHAVIORAL SCIENCES						
41100000			# History of anthropology*					
41200000			# History of psychology*					
41300000			# History of sociology*					
41400000			# Demography (Includes population characteristics, density, growth.) (For statistical aspects of demographic studies, see Statistics; for methodology of demography see Methodology and research techniques in the behavioral sciences.)					
41500000			Methodology and research techniques in the behavioral sciences (For the applicable knowledge of statistics see Statistics.)					
41510000				Research design techniques				
41511000					# Continuing study design (Includes longitudinal studies.)			
41512000					# Descriptive study designs			
41513000					# Experimental study designs (Includes manipulative designs, after only, before-after, post-test control group, pre-test/post-test control group, multiple control group, Solomon Four Group design.)			
41514000					# Data collection methods			
41515000					# Sampling methods (Includes survey and other sampling methods.)			
41520000				Intelligence and ability and their measurement				
41521000					General intelligence and its measurement (Includes Stanford-Binet, Wechsler Scales, group tests, performance and non-language tests.)			
41521100						#Adult intelligence and its measurement		
41521200						#Infant and preschool intelligence and their measurement		

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Intelligence and ability and their measurement (continued)

41522000 # Differential abilities and aptitudes and their measurement (Includes tests of sensory capacities, motor functions, mechanical aptitudes, clerical aptitudes, artistic aptitudes, musical aptitudes, literary appreciation, creativity, reasoning.)

41523000 # Achievement and achievement measurement (Includes tests of General Educational Development, California Achievement Tests, Iowa Tests of Basic Skills, Stanford Achievement Tests, proficiency examinations, performance evaluation, High School Equivalency, Scholastic Aptitude Tests, Graduate Record Examinations, licensure examinations.)

41530000 Personality measurement (See also Personality theory.)

41531000 # Personality inventories (Includes Cattell 16 Personality Factor Inventory, Bell Adjustment Inventory, Minnesota Multiphasic Personality Inventory, Edwards' Personal Preference Schedule.)

41532000 # Projective techniques (Includes TAT, Rorschach, Rosensweig Picture Frustration, play, psychodrama.)

41540000 # Attitude measurement (Includes Likert's Method of Summated Ratings, Bogardus' Social Distance Scale, Behavioral Differential, Semantic Differential, Thurstone Equal Interval Technique.)

41600000 Behavioral processes of the individual

41610000 Sensation and perception

41611000 Sensation (sensory processes and behavioral manifestations of sense organs) (Includes aspects of sensation such as threshold determination, sensory adaptation, sensory discrimination, sensory deprivation.) (See also Normal structure and function in BIOLOGICAL SCIENCES.)

41611100 # Auditory (Includes masking, pitch, loudness and attributes of tones.)

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	Sensation (continued)
41611200	# Visual
41611300	# Cutaneous (touch)
41611400	# Kinesthetic (motion and location of body and body parts)
41611500	# Taste and smell (chemically based senses)
41612000	Perception (the registration of sensory stimuli)
41612100	# Object perception and perceptual constancies
41612200	# Selection, attention and set
41612300	# Perceptual organization (Includes grouping, closure, figure and ground, distance and depth, direction and orientation, movement, form.)
41613000	# Extrasensory perception
41614000	# Subliminal perception
41615000	States of awareness
41615100	# Hypnotically induced states
41615200	# Hypnogogic states
41615300	# Sleeping phenomena
41615400	# Drug induced states of awareness (See also Pharmacology.)
41620000	Learning theory (Includes reinforcement patterns and schedules, extinction, spontaneous recovery, reconditioning, generalization and discrimination.)
41621000	# Conditioned response learning (Includes classical and operant conditioning.)
41622000	# Cognitive learning (Includes Gestalt learning and other cognitive learning approaches.)
41623000	# Motivational approaches to learning (Includes drive reduction.)

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Learning theory (continued)

41624000 # Verbal learning (See also Psycholinguistics.)

41625000 # Perceptual motor learning

41626000 # Retention and forgetting (Includes massed and distributive practice, whole-part, overlearning, short-term and long-term memory phenomena.)

/ 41627000 # Transfer of training

41630000 # Thought processes (Includes creative thinking, concept formation, problem solving, adaptive thinking, symbolic thinking.)

41640000 Motivation

41641000 # Autonomic drives (Includes hunger, thirst, regulation of temperature, conditions of arousal of, selective and directional behavior of, satiation and gratification of autonomic drives.)

41642000 # Sex drives (Includes conditions of arousal of, selective and directional behavior of, satiation and gratification of sex drives.)

41643000 # Learned bases of motivation (Includes ego-adaptive and social motives such as power, prestige, conditions of arousal of, selective and directional behavior of, satiation of, and gratification of learned bases of motivation.)

41650000 # Emotions (Includes conditions of arousal of emotions, disruptive and adaptive aspects of emotions, mood change.)

41660000 Development and growth of behavioral processes of the individual (See also Normal structure and function, Growth and development in BIOLOGICAL SCIENCES.)

41661000 # Motor development

41662000 # Perceptual development

41663000 # Cognitive development

41664000 # Language development (See also Psycholinguistics.)

	1	2	3	4	5	6	7	8
				Development and growth of behavioral processes of the individual (continued)				
41665000					# Emotional (affective) development			
41666000					Stages of development of behavioral processes of the individual			
41666100						# Infant behavioral development (Includes mother-child interaction, adaptive behavior.)		
41666200						# Childhood behavioral development		
41666300						# Adolescent behavioral development		
41666400						# Young adulthood behavioral development		
41666500						# Adult behavioral development		
41666600						# Old age behavioral development		
41666700						# Death and dying behavioral development		
41670000	SS			# Personality theory (structure and functioning of normal personality) (Includes such personality theories as psychoanalytic, self, field and ego and the ways in which they are synthesized in actual application; determinants of personality.)				
41680000				# Attitude theory (Includes attitude formation, structure and change within the individual.)				
41690000				Psychopathology (For Neurological disorders see Pathology.)				
41691000					# Mental retardation (See also Pathology in BIOLOGICAL SCIENCES.)			
41692000					# Organic brain syndromes (See also Pathology in BIOLOGICAL SCIENCES.)			
41693000					# Psychoses (Includes schizophrenia, affective disorders, paranoid states.) (Excludes psychoses of organic brain syndromes.)			
41694000					# Neuroses			

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Psychopathology (continued)

41695000		Personality disorders and other non-psychotic mental disorders
41695100		# Personality disorders (Includes personality disorders such as the obsessive-compulsive, asthenic, passive-aggressive personality.) (Note that this category excludes neuroses and psychoses.)
41695200		# Disorders involving addictive behavior (Includes alcoholism, drug dependence.) (See also Pharmacology.)*
41696000		# Psychosomatic disorders (psychophysiological disorders)
41697000		# Transient situational disturbances (temporary psychopathological disturbances due to acute situational stress)
41710000	SS	Psychotherapy and counseling
41711000		# Individual psychotherapy and counseling*
41712000		# Group psychotherapy and counseling*
41713000		# Occupational therapy (as a psychotherapeutic technique) (For vocational rehabilitation see Rehabilitation medicine.)
41714000		# Recreational therapy (as a psychotherapeutic technique) (For therapeutic recreation involving physical disorders see Rehabilitation medicine.)
41720000		# Organic therapy (Includes chemotherapy, insulin and sub-insulin shock therapy, electroshock therapy.) (See also Pharmacology.) (For surgical treatment see Surgery, Normal structure and function in BIOLOGICAL SCIENCES.)
41800000		Social processes and social structures
41810000	SS	Culture (Includes cross-cultural comparisons among primitive and modern societies.) (See also HISTORY.)
41811000		# Technological and material aspects of culture (Includes handicrafts, clothing and adornment, housing, travel and transportation, tools, weapons, machinery.)*

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Culture (continued)

41812000 # Artistic expressions of culture (what any given art form reflects about a particular culture) (See also HUMANITIES AND THE ARTS.)*

41813000 # Scientific achievements (Includes advancements in environmental adaptation, medicine, astronomy.)*

41814000 SS # Belief systems (Includes religious, mythological, cosmological and ethical systems.) (See also RELIGION and PHILOSOPHY.)*

41815000 # Economic organization (Includes division of labor, systems of production, exchange and consumption, property concepts.) (See also ECONOMICS.)*

41816000 # Political organizations as an expression of culture (Includes temporary, egalitarian and stratified forms of government.) (See also POLITICAL SCIENCE.)*

41817000 SS # Language as an expression of culture (Includes structural and functional relationship of language to culture.) (See also LINGUISTICS AND LANGUAGES.)*

41818000 # Personality and attitudinal manifestations of culture (Includes concepts of acceptable social role behavior and deviance, attitude towards strangers within and outside of culture.)*

41819000 # Social organization (Includes family structure and kinship groups, marriage, birth, initiation, puberty, courtship patterns, descent and age group systems, sexual and status relations between sexes.)

41820000 SS # Interpersonal (dyadic--two person interaction) processes

41830000 # Social perception (perception by individuals of other people and social phenomena)

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Social processes and social structures (continued)

41840000	Social groups and processes (Includes group processes.)
41841000	# Small group behavior (structure and dynamics of small groups)
41842000	# Large group behavior (Includes crowds, mobs, mass demonstrations.)
41843000	# Leadership (Includes authoritarian, laissez-faire and democratic styles.)
41844000	# Distribution and use of power
41845000	# Communication patterns in groups (Includes verbal and non-verbal aspects.)
41846000	# Functional roles of group members
41847000	# Group boundaries
41848000	# Reference group effect on behavior
41849000	# Group decision-making
41851000	# Goal-setting (Includes group norms and standards.)
41852000	# Group cohesiveness
41853000	# Group effectiveness (Includes productivity.)
41860000	Inter-group processes
41861000	# Group differences in social attitudes, principles, beliefs, norms, and behavior
41862000	# Conflict theory (Includes types of conflict, manifestations of conflict, conflict resolution.)
41863000	# Social groups and structures as a basis of stratification
41863100	# Class stratification (socio-economic)
41863200	# Castes (Includes other means of differentiation in traditional societies.)
41863300	# Race, ethnic groupings, and other forms of minority-majority stratification (Excludes class and caste stratification.)

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Race, ethnic groupings and other forms of minority-majority stratification (continued)

41863310 # Ethnic groups as a basis of stratification

41863320 # Religion as a basis of stratification

41863330 # Sex as a basis of stratification

41863340 # Race as a basis of stratification

41863350 SS # Special problems of stratification in the United States

41863351 # The Negro in the United States

41863352 # The American Indian in the United States

41863353 # The Mexican-American in the United States

41863354 # Puerto Ricans and other Latin-Americans in the United States

41863355 # Orientals in the United States

41863356 # Jews in the United States

41864000 # Social diffusion (the transmission of cultural traits from one group to another) (Includes the concept of spontaneous invention.)

41865000 # Acculturation, assimilation, and integration (the processes of adjustment of different social groups or societies existing side-by-side)

41870000 Social change

41871000 Cultural and social evolution and revolution

41871100 # Evolutionary social change

41871200 # Revolutionary social change (Includes techniques and strategies.)

41871300 # Technology and social change

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Social change (continued)

41872000 # Social disorganization (affecting individuals and groups) (Includes alienation, suicide, environmental abuse.)

41880000 Institutional structures and social processes

41881000 # Socialization processes (those mechanisms which transmit social values and practices) (Includes ceremonies, customs, rewards, sanctions.) (See also Development and growth of behavioral processes of the individual, and Culture.)

41882000 # Mass communication processes and public opinion (Includes use of media techniques to influence opinions and behavior, propaganda, effects on prejudices, stereotypes.)

41883000 # Community groups, community control, and community organization (techniques and theories.)

41884000 SS Social service administration and policy (See also ECONOMICS and POLITICAL SCIENCE when applicable; see also Psychotherapy and counseling.)

41884100 # Social services for the poor or indigent administration and policy (Includes welfare.)

41884200 # Health services administration and policy (Includes public health and family health services, hospital-based services.)

41884300 # Educational and training services administration and policy (For Methods of education and training see EDUCATION.)

41884400 # Employment services administration and policy

41884500 # Legal services administration and policy

41884600 # Child care services administration and policy

41884700 # Recreational services administration and policy

41884800 # Special services for the aged or infirm administration and policy

41884900 # Consumer protection services administration and policy (See also ECONOMICS.)

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	Social service administration and policy (continued)
41885100	# Social agencies (public and private) administration and policy
41886000	Organizational theory (analysis and techniques)
41886100	# Formal and informal organization (Includes approaches to organizational analysis such as the structuralist theory.)
41886200	# Organizational co-ordination (Includes "linking pin" work group, cross-departmental committees, matrix organization, service procedure in bureaucracy.)
41886300	# Organizational design (Includes centralization-decentralization, departmentation, line-staff organization.)
41886400	# Organizational change
42000000	EDUCATION
42100000	Educational foundations
42110000	# History of education (Includes descriptive educational history, history of educational thought.)*
42120000	Educational behavioral sciences
42121000	# Educational behavioral processes (For the study of specific behavioral processes such as learning theory, motivation, etc., see also Behavioral processes.)
42122000	# Educational social processes (For the study of specific social processes such as small group behavior see also Social processes and social structures and other appropriate SOCIAL SCIENCES.)
42200000	# Curriculum design (Includes subject curriculum, correlated curriculum, broad fields curriculum, core curriculum, experience or activity curriculum.)

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EDUCATION (continued)

42300000	SS	# Systems of content presentation (Includes procedures such as lecture, symposium, panel, forum, role-playing, case study, demonstration, colloquium, audio-visual techniques, programmed instruction, micro-labs and laboratory methods.)
42400000		# Educational administration (See also BEHAVIORAL SCIENCES, Social processes and social structures.)
42500000		Stages of education
42510000		# Preschool education
42520000		# Elementary school education
42530000		# Secondary school education
42540000		# General adult education
42550000		# College level education
42600000		Specialized education
42610000		# Vocational education
42620000		# Technical education
42630000	SS	# Professional and graduate education
42700000		Special education
42710000		# Education of the blind and visually impaired
42720000		# Education of the deaf and hearing impaired
42730000		# Education of the physically handicapped
42740000		# Education of the mentally retarded
42750000		# Education of the intellectually gifted
42760000		# Education of the emotionally disturbed
42770000		# Education of the neurologically impaired
42780000		# Remedial education for children and adults
42800000		# Educational guidance (counselor education)

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SOCIAL SCIENCES (continued)

4300000 ECONOMICS (See also related subjects in the other SOCIAL SCIENCES, MATHEMATICS and STATISTICS.) (For econometrics see appropriate methods in MATHEMATICS and STATISTICS and appropriate subject categories.)

43100000 # Economic history and philosophy (Includes history of economic thought, philosophic questions related to the methodology of economics and history of economic events.)*

43200000 # Micro-economics (theory of the firm and the household) (Includes marginal analysis of product and factor costs and pricing, perfect and imperfect competition.) (For study of actual market analysis and industries see Managerial economics and Industrial organization.)*

43300000 # Macro-economics (theory of the economy as a whole) (Includes the theory of income, employment, price and investment determinations in the economy as a whole, monetary theory and governmental fiscal options of spending and taxation.) (See also Economic growth, development and planning and Labor, manpower and human resources.) (For social accounting see Business and social accounting.)*

4340000 # International economics (Includes theory of trade, common markets and international trade agreements.) (For accounting aspects of balance of payments see Business and social accounting.)*

43500000 # Economic growth, development and planning (Includes both advanced industrial, newly industrial and pre-industrial societies, comparative economic systems.)*

43600000 # Labor, manpower and human resources (Includes labor economics, industrial relations, labor force analysis, wage and salary administration, job analysis, and manpower development as an economic concept.)*

43700000 # Consumer economics (Includes consumer protection, business practices related to consumer interests, money management for the household.)*

43800000 # Regional and urban economics (Includes economic geography, location theory, regional economic planning, economic problems of urban areas.) (For input-output analysis for regions see Quantitative economics.)*

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ECONOMICS (continued)

43900000 # Quantitative economics (Includes quantitative methods identified with the field of economics such as input-output analysis, indifference analysis, geometric analysis, equilibrium analysis.) (For statistical and mathematical techniques used in mathematical economics and econometrics see appropriate categories in Mathematics and Statistics.)*

44100000 Industrial organization (applied economics)

44110000 # Industrial finance*

44120000 # Industrial regulation and control (See also LAW.)

44130000 # Industry studies (Includes study of actual industries, conditions of entry, concentration, product differentiation, size and demand.)

44140000 # Managerial economics (Includes organization of production, decision-making.) (See also Organizational theory in the BEHAVIORAL SCIENCES.)

44141000 # Marketing and forecasting (See also BEHAVIORAL SCIENCES.)*

44142000 # Cost analysis (costs of production, overhead costs, capital costs, financial costs related to output and production) (Includes cost accounting, break-even points, cost aspects of benefit-cost analysis.)*

44143000 # Business and social accounting (Includes profit and loss statements, balance sheets, capital accounts, production accounts for the firm or the economy as a whole; bookkeeping, money flows, accounting aspects of balance of payments.) (For input-output analysis see Quantitative economics.)

45000000 POLITICAL SCIENCE

45100000 # Political history (Includes the development of cultural and national contexts, theories of city-state, universal community, national states.)

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POLITICAL SCIENCE (continued)

45200000	# Systemic analysis (political systems) (Note that the categories included below each refer to the processes by which individuals act through such institutional and associational interest groups as political parties, legislatures, armies, bureaucracies, trade unions, business organizations, ethnic associations, professional associations, religious organizations, and civic groups. Where applicable these processes also include those expressed through political functionaries, tribunals, courts, mass media and extra-legal or secret groups and societies.) (See also Institutional analysis.)
45210000	# Interest articulation (the process by which individuals make demands upon the political decision makers)
45220000	# Interest aggregation (the conversion of demands into general policy alternatives)
45230000	# Rule-making and legislation (establishment of rules imposing obligations and the limiting of conflicts)
45240000	# Rule-application (the application of laws and statutes to particular circumstances)
45250000	# Rule-adjudication (the making of authoritative decisions on whether a rule has been transgressed in a given case)
45260000	# Communication (the flow of information in political systems) (Note that this process involves informal face-to-face contacts and formal governmental structures)
45270000	# Rule-transformation (Note that this category includes institutional forms as well as revolution, war, rebellion.)
45300000	Institutional political analysis (Note that the categories included refer to the powers, recruitment and situational role of the particular institution.) (See also Systemic analysis.)

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Institutional political analysis (continued)

45310000	Political organization of individual nations
45311000	# Institutionalized national government (those institutionalized forms which represent the embodiment of constituted government) (Includes executive, legislative, judicial and law enforcing structures and function.)*
45312000	# Non-institutionalized forms of national government (those political institutions which affect but do not represent constitutional government such as political parties, political movements and lobbies.)*
45320000	Supra-national and international political organization
45321000	# Institutionalized international government (those institutionalized forms which represent the embodiment of internationally constituted government such as the United Nations, World Court, trusteeships, formal military alliances)*
45322000	# Non-institutionalized international government (those political institutions which affect international government but do not represent constituted government, such as international political movements, informal alliances, pacts.)*

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50000000		MATHEMATICS AND RELATED DISCIPLINES
51000000	SS	MATHEMATICS
51100000		Foundations of mathematics
51110000		# Mathematical logic (Includes symbolic logic, mathematical reasoning, Boolean algebra.)
51120000		Set theory
51121000		# Point sets
51122000		# Set theory approach to relations and functions
51123000		# Mathematical induction
51124000		# Cardinality
51125000		# Combinatorial analysis (Includes combinations, permutations, patterns, methods of enumerations involving use of theory of finite sets.)
51126000		# Elementary number theory (Includes divisibility, primes, congruences.)
51200000		Algebra
51210000		# Group, ring and field theory (Includes the study of algebraic laws governing real and complex numbers.)
51220000		Linear and multilinear algebra
51221000		# Pure linear algebra (Includes matrices, transformations, determinants, eigenvalues, eigenvectors, Jordan canonical form, idempotents, bilinear, quadratic, and hermitian forms, convex sets.)
51222000		# Pure multilinear algebra
51223000		Applied linear and multilinear algebra
51223100		# Vector analysis and field theory
51223200		# Tensor analysis (See also Differential geometry.)
51223300		# Harmonic analysis

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Applied linear and multilinear algebra (continued)

51223400 Mathematical programming (mathematical expression of systems)

51223410 # Graph theory (flow through different lines on graphs) (See also Network flows and Linear programming.)

51223420 # Network flows (Includes Ford-Fulkerson theory, maximum flows and minimal cost flow algorithms.)

51223430 # Linear programming (Includes simplex algorithm, duality theorem, stochastic linear programming, and computational methods for large linear programs.)

51223440 # Dynamic programming (deterministic) (For probabilistic see Applied probability and Stochastic processes.)

51223450 # Integer programming (Includes discrete, cyclic, and mixed algorithms.)

51223460 # Non-linear programming (Includes computational methods for unconstrained and constrained optimization problems in finitely many variables.)

51230000 # Categories and homology

51240000 # Algebraic topology

51250000 # Algebraic geometry

51260000 # Algebraic number theory (Note that this category excludes elementary number theory concerned with divisibility.)

51300000 Mathematical analysis

51310000 # Functions of real and complex variables

51311000 # Elementary functions and analytic geometry (Includes ordinary algebraic and transcendental functions and their graphs, polynomials, trigonometric and exponential functions.)

51312000 # Sequence, series, limits

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Functions of real and complex variables (continued)

51313000 # Differential and integral calculus

51314000 # Summability (of numbers and functions)

51315000 # Analytic function theory (Includes complex integration, residue theory, Riemann surfaces, functions of several complex variables, conformal mapping.)

51316000 # Analytic number theory (Refers to analytic number theory, as opposed to algebraic number theory, and to elementary number theory, which is contained in set theory or group, ring and field theory.)

51317000 # Fourier analysis (Includes exapansion, convergence, completeness, basic integral transform theory, multiplier transforms, Hilbert transform, finite transforms, Hankel transform.)

51320000 # Measure theory (Includes Lebesgue and Stieltjes integration.)

51330000 # Ordinary and partial differential equations (Includes ordinary linear and non-linear differential equations and systems of equations, Sturm-Liouville theory, Poincare-Bendixson theory, elliptic, parabolic, hyperbolic and mixed type theories in the linear case including systems of partial differential equations in the linear and non-linear case.)

51340000 # Differential geometry (classical geometry)

51350000 # Functional equations (coupled equations based on their functional relationships)

51360000 # Integral equations (Includes linear and non-linear equations.)

51370000 # Variational methods in mathematics (Includes Euler's equation and applications, isoperimetric problem, direct methods.) (See also Ordinary and partial differential equations.)

51380000 # Theory of elliptic functions and integrals (Includes elliptic integrals of first, second, third kinds, elliptic functions, real and complex representations, conformal representations.) (See also Analytic function theory.)

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Mathematical analysis (continued)

51390000		# Asymptotic methods in mathematics (Includes asymptotic treatment of ordinary and partial differential equations and integrals encompassing methods such as "stationary exponents" and "steepest descent.")
51410000		# Perturbation theory (Includes regular and singular theories.)
51420000		# Approximation theory (Includes indirect methods such as "contraction maps" and "fixed-point theorems" and direct methods such as the "Rayleigh-Rite method".)
51430000		# Numerical analysis (Includes finite-difference technique, interpolation, quadratures, numerical techniques in ordinary and partial differential equations, determinants, matrix inversions, the theory of error analysis.)
51500000		Topology
51510000		# Point set topology
51520000		# Functional analysis on topological vector spaces
51530000		# Analysis on topological spaces with an algebraic structure
51540000		# Differential topology
51600000		Geometry
51610000		# Euclidean geometry (Includes descriptive geometry which in turn includes aspects of engineering drawing.)
51620000		# Non-euclidean geometry
51630000		# Projective geometry
52000000	SS	PROBABILITY AND STATISTICS
52100000		Probability and stochastic processes
52110000		# Stochastic processes
52120000		# Sampling distribution (Includes univariate, bivariate, multivariate cases.)
52130000		# Combinatorial probability (Note that this category excludes sampling distribution.)

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Probability and stochastic processes (continued)

52140000	# Probability in continua
52150000	Applied probability and stochastic processes
52151000	# Markov processes
52152000	# Queuing (Includes birth and death processes, congestion, mass service and related stochastic systems.)
52153000	# Martingales
52154000	# Mathematical reliability (Includes design, planning, and testing for reliability using appropriate probability distributions.)
52155000	# Mathematical inventory (Includes optimal policies for dynamic inventory, and production planning models with deterministic requirements.)
52156000	# Dynamic programming (probabilistic) (For deterministic dynamic programming see Applied linear and multilinear algebra.)
52157000	# Stationary series estimation (Includes the univariate and multivariate cases.)
52158000	# Correlogram or spectral analysis (Includes the univariate and multivariate cases.)
52159000	# Game theory
52161000	# Statistical decision theory
52200000	Statistics
52210000	Foundations of statistics
52211000	# Logic of inductive inference
52212000	# Measurement (Includes scaling, dimensional analysis.)
52220000	# Descriptive statistics (Includes standard frequency and distribution functions, measures of location such as mean (average), median, and mode, measures of dispersion such as range and standard deviation, and graphic and tabular representation of data.)
52230000	# Statistical design of experiments

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Statistics (continued)

52240000	#Sampling theory (Includes random sampling, stratified sampling, cluster sampling, purposive sampling.)
52250000	Statistical theory of relationships
52251000	# Functional relationships (See also Measurement.)
52252000	# Correlation and regression analysis (Includes linear and non-linear, simple and multiple regression analysis; trend-fitting and time-series analysis involving linear regression.)
52253000	# Factor analysis
52254000	# Latent structure analysis
52255000	# Discriminant function analysis
52260000	# Statistical inference
52261000	Estimation
52261100	# Fixed sample size methods of estimation
52261110	Parametric methods of fixed sample size method of estimation
52261120	Non-parametric methods of fixed sample size method of estimation
52261200	# Sequential methods of estimation
52261210	Parametric methods of sequential methods of estimation
52261220	Non-parametric methods of sequential methods of estimation
52262000	Hypothesis testing
52262100	# Fixed sample size methods in hypothesis testing
52262110	Parametric methods of fixed sample size methods in hypothesis testing
52262120	Non-parametric methods of fixed sample size methods in hypothesis testing

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	Hypothesis testing (continued)
52262200	# Sequential methods
52262210	Parametric methods of sequential methods in hypothesis testing
52262220	Non-parametric methods of sequential methods in hypothesis testing
52263000	# Analysis of variance and covariance (Includes linear and non-linear normal models.)
52264000	# Spectral analysis (Includes cross-spectral methods for multiple time series analysis and detection of periodicities and other special effects.)
53000000	CYBERNETICS AND COMPUTER SCIENCES
53100000	Cybernetics
53110000	# Foundations of cybernetics (concepts of control and communication in living organisms, machines, organizations and other systems)
53120000	# General systems theory (Includes levels of complexity of systems, organization of systems, interaction of parts of systems.)
53130000	Control theory (Refers to "classical" system design theory.) (For "modern" or "state space" system design theory, see the appropriate areas of Mathematical analysis; for the appropriate areas of application, refer to relevant categories in other disciplines, e.g., ENGINEERING AND TECHNOLOGY, SOCIAL SCIENCES.)
53131000	# Open loop systems
53132000	# Feedback ("servo") systems
53133000	# Self-adaptive and "learning" systems
53140000	# Communication theory (Refers to the cybernetic function of communication and control involved in the transfer of information from one source to another.)

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Cybernetics (continued)

53150000	# Information theory (Refers to the cybernetic function of information theory as a means of communication and control) (Includes message transmission, encoding decoding, information as negative entropy.)*
53200000	Computer sciences (For the mathematics involved in computer sciences see MATHEMATICS, PROBABILITY AND STATISTICS, ENGINEERING AND TECHNOLOGY.)
53210000	Computer programming
53211000	# Systems programming
53212000	# Application-oriented programming
53220000	# Computer languages*

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60000000	HUMANITIES AND THE ARTS
61000000	PHILOSOPHY (For philosophy of particular fields, see categories listed under appropriate fields e.g. Philosophy of music and Philosophy of literature.)
61100000	Systematic philosophy
61110000	# Logic
61120000	# Ethics
61130000	# Aesthetics
61140000	# Epistemology
61150000	# Metaphysics
61151000	# Cosmology
61152000	# Ontology
61200000	Historical philosophy
61210000	# Western philosophy*
61220000	# Eastern philosophy*
62000000	RELIGION
62100000	# Systematic and doctrinal religion
62200000	# Sacred writings and lore
62300000	# Religious worship (Includes liturgy, sacraments and rites, religious music and dance as they relate to worship.)
62400000	# Comparative religion
62500000	Religious traditions and sects
62510000	# Judaism
62520000	# Christianity
62530000	# Islam
62540000	# Ancient Near Eastern and Greco-Roman religions
62550000	# Buddhism (Includes Zen, Hinayana, Mahayana, Tantrism.)

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Religious traditions and sects (continued)

62560000		# Hinduism
62570000		# Confucianism-Taoism
62580000		# African religions*
62590000		# Polynesian religions*
62610000		# American Indian religions*
63000000		LITERATURE (For techniques of writing literature, see Writing.)
63100000		# History of literature and of literary criticism*
63200000		# Philosophy of literature*
63300000	SS	Literary forms
63310000		# Poetry
63320000		# Prose
63330000		# Drama
63400000		Literature of ancient civilizations
63410000		# Literature of ancient Greece
63420000		# Literature of ancient Rome (Latin literature)
63430000		# Persian literature
63440000		# Ancient Hebrew literature
63450000		# Assyrian literature
63460000		# Phoenician literature
63470000		# Babylonian literature
63480000		# Syriac literature (aramaic)
63490000		# Arabic literature (through Dark Ages)
63500000		Western literature
63510000		# Literature of Spain*
63520000		# Latin-American literature in Spanish*

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Western literature (continued)

63530000	# Portuguese literature*
63540000	# Brazilian literature (Latin-American literature in Portuguese)*
63550000	# Germanic literature*
63560000	Netherlandic literature*
63561000	# Dutch (Frisian) literature*
63562000	# Afrikaans literature*
63570000	# Belgian literature*
63580000	Scandinavian literature
63581000	# Icelandic literature*
63582000	# Danish and Faroese literature*
63583000	# Norwegian literature*
63584000	# Swedish literature*
63590000	# Italian literature*
63610000	# French literature*
63620000	# Greek literature*
63630000	# Middle Eastern literature (Arabic)*
63640000	# Hebrew literature*
63650000	Eastern European literature
63651000	# Russian literature*
63652000	# Eastern European literature other than Russian*
63660000	Literature of the British Isles and colonies including American
63661000	# Celtic literature*
63662000	# Irish literature in English*
63663000	# Welsh literature in English*

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	Literature of the British Isles and colonies including American (continued)
6 3664000	# Scottish literature in English*
6 3665000	# Australian and New Zealand literature*
6 3666000	# South African literature in English*
6 3667000	Canadian literature
6 3667100	# French Canadian literature*
6 3667200	# Canadian literature in English*
6 3668000	# Literature of England*
6 3669000	# North American literature*
6 3670000	Trends, movements and schools in Western literature and literary criticism
6 3671000	# Humanism
6 3672000	# Baroque and Rococo
6 3673000	# Classicism and Neo-Classicism
6 3674000	# Romanticism
6 3675000	# Realism
6 3676000	# Naturalism
6 3677000	# Symbolism
6 3678000	# Imagism
6 3679000	# Surrealism and Dadaism
6 3681000	# Expressionism
6 3692000	# Existential literature
6 3693000	# Impressionism
6 3694000	# Supernaturalism and Gothicism
6 3695000	# Literature of the absurd
6 3696000	# Pre-Raphaelite literature

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	Trends, movements and schools in Western literature and literary criticism (continued)
63697000	# Comic tradition
63698000	# Tragic tradition
63699000	# Oral tradition
63711000	# Epic tradition
63712000	# Folklore and mythology (written)
63800000	Eastern literature
63810000	# Chinese literature*
63820000	# Japanese literature*
63830000	# Indian literature*
63840000	# Southeast Asian literature*
63850000	# Malay-Polynesian-Javanese literature*
63900000	# African literature*
64100000	American Indian literature (pre-colonial)
64110000	# North American Indian literature*
64120000	# South American Indian literature*
65000000	THE ARTS (See also Aesthetics.)
65100000	# Environmental design (Includes architecture.)*
65200000	Visual art
65210000	# History of visual art*
65220000	# Art theory (Includes line theory and contour, light and shade, perspective, spatial relationships, texture, proportion, symmetry, two and three dimensional design.)
65230000	# Color

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Visual art (continued)

65240000		Art media (techniques of)
65241000		# Drawing (Includes figure and anatomical drawing, sketching and rendering.)
65242000		# Painting (Includes brushing, spattering, stippling, rolling, spraying, drybrush-scumbling.)
65243000		# Sculpture and relief (Includes modeling, carving, casting, welding, molding.)
65244000		# Graphics (Includes etching, dry-point, engraving, lithography, offset, silkscreen and stencil serigraphy, woodcut and wood engraving, linoleum prints, monotype.)
65245000		# Calligraphy (lettering)
65246000		# Ceramics and pottery (Includes modeling, turning, glazing, enameling.)
65247000		# Mosaic (Includes direct and indirect applications.)
65248000		# Textiles and weaving (Includes hand weaving, embroidery, batik, pettipoint, tie dye, decorative sewing.)
65249000		# Display and theatrical design
65251000		# Lighting
65252000		# Jewelry (Note that this category excludes commercial manufacture of jewelry.)
65260000	SS	# Photography and cinematography (Includes still and television photography.)*
65300000		Dance
65310000		# Dance history*
65320000		# Dance choreography
65330000		# Dance performance (Includes classical ballet, jazz dance forms, modern ballet, ballroom or social dance, folk and ethnic dance.)
65340000		# Dance notation (Includes Labonotation, Benesh, Eshkol, effort shape.)

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THE ARTS (continued)

65400000 # Performing dramatic arts (Includes acting and pantomime.)*

65500000 Music

65510000 # Music history (Includes music existing both before and after the invention of notation.)*

65520000 # Philosophy of music*

65530000 Systematic musicology

65531000 # Music acoustics (Includes sound, intervals, consonance and dissonance, resonance, pitch, acoustic properties of musical instruments, systems of tuning.) (For physical aspects of these acoustic properties, see PHYSICS, MATERIALS.)

65532000 # Music physiology (effect of the human voice and body, as mechanisms, on the production and forms of music; relationship of human anatomy and music) (See also Normal structure and function in the BIOLOGICAL SCIENCES, Phonetics in LINGUISTICS AND LANGUAGE.)

65533000 # Music psychology (relationship of the perception of musical sounds and the experience of emotions; relationship of music to the human senses and intellect) (See also Behavioral processes.)

65534000 # Music theory (Includes melody, rhythm, harmony, scales, tonal systems, counterpoint, score reading, clefts, transpositions, eartraining, music and rhythm dictation, pitch recognition, form.)

65535000 # Composition (Includes types of compositions such as symphony, ballad, folk song.)

65536000 # Orchestration

65537000 # Ethnomusicology (Includes descriptive ethnomusicology--folk tradition of an ethnic group in a particular place; analytical ethnomusicology--how musical traditions produced by different cultures interact; cultural determinants of music--how culture produces music.) (See also Social processes.)

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	Music (continued)
65540000	Music performance
65541000	# Voice (Includes methods of singing, effects of body on voice.) (See also Normal structure and function in BIOLOGICAL SCIENCES, Phonetics in LINGUISTICS AND LANGUAGE.)
65542000	# Conducting
65543000	Instruments
65543100	# Bowed strings (Includes violin, violas, violincello, bass.)
65543200	# Plucked strings (Includes harp, lutes, zithers, mandolin, bandolin, guitars, ukelele, banjos, sitar, electric bass.)
65543300	Keyboard instruments
65543310	# Keyboard strings (Includes piano, harpsichord.)
65543320	# Organs
65543400	# Reed instruments with keyboard and bellows (accordions, accorgan, concertinas.)
65543500	Lip instruments
65543510	# Flue instruments (Includes flutes, recorders.)
65543520	# Reed instruments (Includes oboe, bassoons, clarinets, saxophone.)
65543530	# Bagpipes
65543540	# Brass instruments (Includes french horn, mellophone, trumpet, coronet, bugles, trombones, sousaphone, tuba.)
65543550	# Mouth organs

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Instruments (continued)

65543600	Percussion instruments
65543610	# Tuned percussion instruments (Includes tympani, dumbeg, steel drums, African lukembi, marimba, vibraphone, xylophone.) (For keyboard instruments see Keyboard instruments.)
65543620	# Untuned percussion instruments (Includes snare, tenor, bass, cocktail and conga drums, bongos, tambourine, triangle, castanets, cymbals and gong, maracas, guiro.)
65600000	Writing
65610000	# History of writing (For paleography see HISTORY.)*
65620000 SS	# Mechanics of writing English (Includes traditional (prescriptive) grammar, punctuation, spelling, bibliographic and footnote form.) (For mechanics of writing other languages see Languages; for the study of grammar see Linguistics.)
65630000	# Techniques of writing
65631000	# Figurative language and imagery (Includes figures of speech, metaphor.)
65632000	# Symbolism (Includes allegory.)
65633000	# Dialogue
65634000	# Characterization
65635000	# Plot structures (Includes pacing, climax and anticlimax.)
65636000	# Comedy techniques (Includes burlesque, irony, satire.)
65637000	# Tragedy techniques
65638000	# Variation of language (Includes alliteration, assonance.)

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Writing (continued)

65640000		Forms of writing
65641000		# Poetry (Includes rhyming poetry, blank verse, free verse.)
65642000		# Prose (Includes novel, short story, essays, biography, autobiography, non-fiction prose, manuals, reports, business correspondence, journalism, criticism.)
65643000		# Dramatic writing
66000000		ARCHAEOLOGY (See also Social processes, HISTORY, for technologies used in the various analyses, see ENGINEERING AND TECHNOLOGY and Stratigraphy under GEOSCIENCES.)
66100000		# Intersite analysis
66200000		# Intra-site analysis
66300000		# Lithic analysis
66400000		# Ceramic analysis
66500000		# Faunal analysis
66600000		# Floral analysis
66700000		# Integrational analysis
67000000	SS	LAW (Except where otherwise stated, the following categories refer to the law of the United States.)
67100000		# Legal history and principles of jurisprudence*
67200000		# Legislation*
67300000		Interpersonal law
67310000		# Property law
67311000		# Estates (Includes future interests, trusts.)
67312000		# Mortgage and lien law

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Interpersonal law (continued)

67320000	# Contracts
67321000	# Sales
67322000	# Commercial law
67322100	Bills and notes
67322200	Banking
67322300	Secured transactions
67330000	# Insurance law (Includes maritime insurance, private medical insurance law.) (For public medical insurance see Administrative procedures, Administrative law; for government regulation of private medical insurance see Administrative law.)
67340000	# Copyrights, patents and trademarks
67350000	# Business organizational relationships (Refers to breach of employment contract, structure of a board of directors.)
67360000	# International business transactions (Includes letters of credit, pacts.)
67370000	# Corporation law
67380000	# Labor law (Includes regulation of child and woman labor, collective bargaining, labor relations.) (See also Business organizational relationships.)
67390000	# Wills
67410000	Torts (status relationships)
67411000	# Torts--domestic relations (Includes child custody, marital relationships, divorce.)
67412000	# Torts--agency (whether one person is acting for another and what his duties and responsibilities are)

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	Torts (status relationships) (continued)
67413000	# Torts--admiralty (oriented towards protection of those on board ship, the passengers and sailors being treated as wards of the court.)
67420000	# Damages
67421000	# Restitution
67422000	# Equity
67500000	State-individual law
67510000	# Individual constitutional rights law
67511000	# Bill of rights law
67512000	# Criminal procedure (as specified by constitutional law, e.g., rights of the accused in criminal cases)
67513000	# Administrative procedure (as specified by constitutional law, e.g., what procedures an administrative agency must follow under the constitution such as the necessity for a hearing, etc.) (Includes welfare law, juvenile courts, corrections, social security, workmen's compensation, unemployment insurance, medicare.)
67520000	# Criminal law (substantive aspects of the law as regards both the individual and private corporation)
67530000	# Military law
67540000	Regulated industries
67541000	# Securities regulation
67542000	# Bankruptcy
67543000	# Administrative law (the scope of the administrative agency over the industry it is regulating)
67550000	# Tax law
67560000	# Municipal corporations (the corporate entity of the city and the laws governing such a governmental agency, e.g., the right of a city to condemn property)

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LAW (continued)

67600000 Inter-state law (conflicts law)

67610000 # Jurisdiction of federal courts

67620000 # International law (Includes comparative law, as it almost always is applied to nations.)

67630000 # Inter-state constitutional law (as it pertains to those aspects of, for example, taxation and commerce dealt with by the constitution in anticipating conflicts between states)

67700000 # Procedures of tribunals

67710000 # Pleading

67711000 Civil procedure (Includes those aspects of criminal procedure distinct from constitutional considerations.)

67712000 Common law pleading

67720000 # Evidence

68000000 HISTORY AND RELATED DISCIPLINES (See also PHILOSOPHY.) (For the history of a particular discipline, see under that discipline.)

68100000 # Historiography (history of historical thought and historical writing)*

68200000 # Prehistory (stone, bronze and iron age history) (See also Social processes, ARCHAEOLOGY.)*

68300000 History (based on geocultural areas)

68310000 # European history (extends to the Ukraine and includes the British Isles, Scandinavia and Iceland)*

68320000 # Near Eastern history (Includes Syria, Palestine, Anatolia, Mesopotamia and Iran.)*

68330000 # Central Asian history (extends from the Ukraine and Turkestan to China)*

68340000 # East Asian history (Includes China, Korea and Japan.)*

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History (based on geocultural areas) (continued)

68350000		# South East Asian history (extends from the Chinese and Indian borders and includes Indonesia)*
68360000		# History of the Indian sub-continent*
68370000		# History of Africa north of the Sahara*
68380000		# Sub-Saharan African history*
68390000		# History of Oceania and Australasia*
68410000		# History of the Polar regions and Greenland*
68420000		American history
68421000		# Latin American history*
68422000		# North American history*
68500000		# Ancillary historical disciplines (Includes genealogy, heraldry, numismatics, papyrology and diplomatics.)*
69000000		LINGUISTICS AND LANGUAGE
69100000	SS	Linguistics
69110000		# History of linguistic disciplines*
69120000		# Lexicography (study of words apart from the systematic framework of synchronic and diachronic linguistics) (Includes descriptive lexicography, lexicographic aspects of dialects, etymology of words, lexicographic aspects of lexicostatistics.) (For statistics used see Statistics.)
69130000		# Diachronic linguistics (study of evolution and development of particular languages and language families)
69131000		# Internal reconstruction
69132000		# Documentary-inscriptional reconstruction

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Linguistics (continued)

69140000 # Synchronic linguistics (structure of language and languages)

69141000 Sound-structure

69141100 # Phonology (systematic treatment of speech sounds) (Includes phonemics and morphophonemics, American structuralist and European schools, and generative phonology.)

69141200 Phonetics (representation of speech sounds and their production)

69141210 # Acoustic and instrumental phonetics (acoustic aspects of speech as studied by means of instruments) (See also Acoustics, ENGINEERING AND TECHNOLOGY.)

69141220 # Articulatory phonetics (position, movement and condition of speech production parts and their effect on sound produced)

69141230 # Perceptual phonetics (See also Behavioral processes, Psycholinguistics.)

69142000 SS # Grammar and semantics (Includes American structuralist grammar, London school grammar, generative grammar (in its various forms), in their syntactic and semantic aspects.) (For prescriptive grammar (traditional rules of usage) see Writing, Mechanics of writing English; for other languages, see Languages.)

69150000 # Dialectology (variations in sound-structure and grammar within a language across regional and class lines) (For lexicographic aspects of dialectology see Lexicography.)

69160000 # Psycholinguistics (See also Behavioral processes.)

69161000 # Developmental psycholinguistics (Includes acquisition of first language by children.)

69162000 # Experimental psycholinguistics (Includes psychology of adult speech comprehension and production; second language learning.)

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Psycholinguistics (continued)

69163000		# Psycholinguistic pathology (Includes linguistic aspects of aphasia, mongoloidism, and other pathologies involving central nervous system; language learning and speech production of the deaf.)
69170000		# Mathematical and computational linguistics (mathematical analyses of linguistics theories, design of computer languages, use of computers in analyzing linguistic data) (See also Mathematical logic; see also ENGINEERING AND TECHNOLOGY, Automata theory.)
69200000	SS	Languages (other than English) (Includes knowledge of oral usage; structure and mechanics of writing the language and traditional grammar, spelling and punctuation.) (For mechanics of writing English see Writing.)
69210000		Indo-European languages
69211000		Germanic languages
69211100		# Afrikaans
69211200		# Danish
69211300		# Dutch-Flemish
69211400		# Frisian
69211500		# German
69211600		# Icelandic
69211700		# Krio
69211800		# Norwegian
69211900		# Swedish
69212100		# Yiddish
69213000		Latin-Romance languages
69213100		# Catalan
69213200		# French

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Latin-Romance languages (continued)

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69213400		# Latin
69213500		# Papiamento
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69214100		# Sardinian
69214200	SS	# Spanish
69215000		# Hellenic language
69216000		# Balto-Slavic languages*
69217000		# Albanian language
69218000		# Armenian language
69219000		# Celtic languages*
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69310000		# Bantu languages*
69320000		# Hottentot-Bushman languages*
69330000		# Australian and Papuan languages*

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Languages (other than English) (continued)

69340000	# American Indian and Eskimo languages*
69350000	# Munda-Mon-Khmer languages*
69360000	# Basque language
69370000	# Hyperborean languages*
69380000	# Caucasian languages*
69390000	# Ainu languages*

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70000000 MISCELLANEOUS DISCIPLINES

71000000 # LIBRARY SCIENCE (Includes selection and acquisition, cataloguing and indexing, reference, and circulation.)*

72000000 # CUISINE (cooking and baking) (Includes all of the types and techniques of food preparation; recipes, including regional or special cuisines.) (For the effects of preparation on nutritional content see Nutrition and dietetics in the BIOLOGICAL SCIENCES.)*

73000000 # MILITARY SCIENCE (Includes those aspects of military weaponry not covered in ENGINEERING AND TECHNOLOGY.) (See also the SOCIAL SCIENCES, MATHEMATICS and ENGINEERING AND TECHNOLOGY where applicable.)*

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X-ray emission / 15223200
X-ray radiation / 15214200
X-rays / 12223000
Xylophone / 65543610

Yiddish , 69212100
Yield criteria / 21321200
Young adulthood behavioral development , 41666400
Yttrium - properties of , 13328000

Zeeman effect / 15222200
Zen / 62550000
Zinc, cadmium, mercury - properties of , 13335000
Zirconium - properties of , 13336000
Zithers / 65543200
Zoologic agencies / 17844000
Zoology , 11700000

SPECIAL SECTION ON CATEGORY CHARACTERISTICS

Certain categories in the Knowledge System have been found to be open to misinterpretation or need elaboration in terms of their use in the System. This section draws the user's attention to several of these. The categories are listed in ascending order of their identification codes. Within the Knowledge System, the letters SS appear to the right of the code numbers of the categories listed here.

11731000 Normal structure and function (The categories listed below include both anatomy and physiology except where otherwise specified.)

This broad level category refers to the physiology and anatomy of the healthy human organism. The category is required for an overview of the nature of the normal interrelationship of systems and processes and for general concepts of "normal" structure and "normal" function. Most of the subdivisions of this category deal with systems of the body and organs. Each of these covers both the anatomy and the physiology of the system or organ named. Two subdivisions refer to anatomy alone (Regional Anatomy, 11731100, and Topographic Anatomy, 11731200). They are used when these aspects of anatomy are required independently from physiology. Two subdivisions are included which refer to solely physiologic processes (Homeostasis of Fluids, 11732300, and Metabolism, 11732400).

11731100 # Regional anatomy (Includes head and neck, thorax and abdomen, pelvis and perineum, lower and upper limbs, and skeleton.)

Regional Anatomy covers internal structure and how the parts of the body structually connect with each other as major sections.

11731200 # Topographic anatomy (relation of external manifestations to internal structure and function, e.g. location of pressure points, surface appearance of joints, muscles and bones.)

Topographic Anatomy includes the relationship between external manifestations and internal structure. The location of a pulse would involve Topographic Anatomy; so too would the palpation of the abdomen done by the doctor who is examining the liver or other internal organs. An MD uses various topographic signposts to locate the organ he wants. Tasks which draw on Surgery may require both Regional Anatomy and Topographic Anatomy in addition to the particular systems involved.

11731300 # Hematopoietic system (Includes blood, red and white blood cells, platelets, and bone marrow, liver and spleen in their blood forming function.)

The Hematopoietic System refers to those aspects of the body concerned with the formation of blood. They include bone marrow and the spleen, liver and lymph nodes in their blood forming capacities. Although the parentheses explanation for this category mentions red and white blood cells, platelets, etc., the reference is not to the shape, size or structure of these cells, but to their formation and function in the body. For tasks which involve the microscopic observation and analysis of blood or urine specimens, the knowledge required is probably that of Cell Morphology (12110000), the structure of cells, rather than knowledge of the Hematopoietic System.

11731500 # Respiratory system

11731600 # Digestive system

11731610 # Mouth, pharynx (digestive function), and esophagus (Includes tongue, teeth, and salivary glands.)

The anatomy and physiology of the mouth and throat is found under the Respiratory System in a non-identifiable category (11731510) and under the Digestive System in Mouth, Pharynx and Esophagus. In its first location the respiratory physiology of the mouth and throat is covered, and in the other category digestive physiology is covered. In a task such as the taking of a throat specimen for a culture, one is not concerned with physiology, yet the task does not require use of Regional Anatomy, per se. The solution is to pick up Mouth, Pharynx and Esophagus (11731610) where it is identifiable and scale for the anatomical aspects involved. Thus, since the full amount of detailed knowledge for the category includes physiology and anatomy, this task would require a narrower aspect than all the detailed knowledge contained in the category.

11731930 # Autonomic nervous system (Includes sympathetic and parasympathetic nerves.)

This category covers the anatomy and physiology of the involuntary nervous system, the sympathetic and parasympathetic divisions of the nervous system. These systems innervate the visceral organs, heart, blood vessels, glands and smooth muscles.

11732100 # Immunologic system (Includes immunological mechanisms, humoral and cellular factors.)

The Immunologic System includes the anatomy and physiology of the organs involved in the body's defense mechanisms against disease and infection. This includes, for example, the production of substances which destroy bacteria and other invading organisms and organs responding to induced immunization such as through innoculation.

11732300 # Homeostasis of fluids (Includes fluid and electrolyte balance.)

This category covers processes involving the body's maintenance of normal states. One should identify this category only when it is needed in its own right, apart from or in addition to a given system of the body.

11732400 # Metabolism

This category covers the physiological and chemical processes by which the human living organism ingests, digests, produces energy, and grows, and includes the coordination of the various physiological processes and their mechanisms. This category should be used only when it is required in its own right, apart from or in addition to a specific system of the body.

11733000 Pathology (abnormal function and structure) (Includes the etiologic and diagnostic aspects of disease.) (See also First aid for emergency treatment and care and Radiobiology.)

This broad level category refers to knowledge of the structural and functional alterations and processes in the human body which are caused by disease or abnormal conditions, or which cause disease or abnormal conditions. The category is required for an overview of the nature of pathology and pathologic origins, processes, course of development and manifestations. It is also required for general prescriptive approaches to treatment, cure and care.

Where illness is involved, the user might choose a category within Pathology describing the pathology type, such as Burns (11734600) or Neoplasms (11733200) and might then also identify the system of the body affected, choosing one of the categories beginning with the words "Disorders of."

Where radiation sickness is involved, the user may also wish to identify Radiobiology (12210000).

Categories listed under Normal Structure and Function rather than those under Pathology are often suggested when it is believed that knowing how something is supposed to be implies knowledge of the abnormal. In such cases users are tempted to omit knowledge of Pathology or its subdivisions. However, the way the subject area of Pathology is defined, it includes the etiologic and diagnostic aspects of disease. Thus, if the performer is expected to use such knowledge at any level, the appropriate categories in Pathology must be identified, either at the broad level of Pathology or under the subdivisions representing specific disorders or pathologies.

11734500 # Perinatal morbidity and mortality (shortly before or after birth)

This category refers to the life endangering pathologies which occur in the period shortly before and after birth. The period is generally considered to begin with the completion of 28 weeks of gestation and is variously defined as ending one to four weeks after birth.

11734800 # Shock and trauma

This category can be a source of some confusion. The word "trauma" is intended to mean a physical wound or injury and excludes psychic trauma which is the type of emotional shock that makes a lasting impression on the mind, particularly the subconscious mind. The word "shock" refers to a physical state rather than an emotional reaction. It is characterized as a condition of acute peripheral circulatory failure due to derangement of circulatory control, or loss of circulatory fluid brought about by injury. The category is applicable in tasks in which the danger of shock and/or trauma are present as well as in treatment of shock and/or trauma. Shock and trauma are not always associated, and one can be present without the other.

The phenomenon of insulin shock, which is brought about by an overdose of insulin, is caused by a too-sudden reduction of blood sugar. It is associated with diabetes. Insulin shock should be coded under Endocrine, Nutritional and Metabolic Disorders (11733300) and not under Shock and Trauma.

11735000 Surgery

Whenever a category covers procedures, its higher scale levels involve knowing the appropriate situations for applications of the procedures, the contraindications, and the results, as well as the techniques themselves. This applies to this broad category and its subdivisions.

11735400 # Introductory procedures (Includes injections, transfusion, irrigation, catheterization, intubation, tracheotomy.)

This category covers a range of activities, some of which are in scale relationship. Irrigations include enemas at a low level on the scale as well as higher-level procedures such as the irrigation of indwelling catheters. Tracheotomy is also included and is still higher on the scale. It involves the clearing of an airway and the introduction of a tube to keep it open. The insertion of endotracheal and nasogastric tubes require this category, as does intubation in saline abortion. All types of injections are also covered by this category.

11735700 # Manipulation (Includes application of plaster, splint or traction, dilation or stretching.)

11737100 # Bandages, dressings, tourniquets and splints

11737400 # Sprains, strains, fractures and their healing

11737700 # Wounds and their healing (Includes operative incisions.)

Where wounds and their care are involved, a variety of categories may be needed. Manipulation covers knowledge of the techniques, materials and applications of casts, splints, traction, dilation and stretching. It covers the choice of the appropriate techniques (some for surgical purposes) as well as their application.

Bandages, Dressings, Tourniquets and Splints covers knowledge of the available types and their respective uses; Wounds and Their Healing and Sprains, Strains, Fractures and Their Healing cover the condition of the type of injury and the healing processes involved, depending on type.

11738000 # Asepsis (concepts and techniques involved in achievement of sterile condition) (Includes concurrent and terminal disinfection during surgery, aspects of sterilization of implements and equipment such as autoclaving.)

11739430 Sanitation (establishment and maintenance of environmental conditions which are favorable to health) (Includes methods of waste disposal, sanitary considerations for food and drink, insect and rodent control.) (For clinical sterilization techniques see Asepsis.)

Asepsis and Sanitation are different knowledge categories and should be distinguished. Asepsis refers to the knowledge of concepts and techniques involving the achievement of sterile clinical conditions free from pathogenic materials, and is involved in such things as sterilizing examination equipment, giving injections and catheterizing a patient,as well as in surgery.

Sanitation involves the extablishment and maintenance of environmental conditions which are favorable to health. While it would normally be related to tasks involving public policy such as rat control and garbage collection, it can be needed in tasks such as teaching a TB patient how to care for a wound under unclean environmental conditions.

11742100 Physical therapy (Excludes speech therapy and hearing therapy.) (See also Mental retardation in the BEHAVIORAL SCIENCES and Special education in EDUCATION.)

11742132 # Corrective, preventive and compensatory adjustments (Includes supportive and self-help devices and their use, such as wheel chairs, trusses, crutches and other mechanical devices and special measures to restore functioning, prevent malfunction (e.g. after surgery), and to make use of partial functions.)

11742133 # Special post-disease and chronic disease therapy (special corrective procedures for the after-effects of disease such as heart disease, rheumatic fever, epilepsy, blindness, diabetes, pulmonary tuberculosis.)

Physical Therapy is a broad category which includes many subdivisions which are required by job titles other than that of the Physical Therapist. The categories under Treatment Modalities (11742140), for example, can be required for tasks associated with many titles in patient care.

Corrective, Preventive and Compensatory Adjustments (11742132) covers colostomy bags and indwelling catheters, as well as wheel chairs and artificial limbs. Special Post-Disease and Chronic Disease Therapy (11742133) is needed for home visits to the chronically ill, those just released from hospitalization, or for any other special care. It may be needed in many health education tasks or in prescriptive tasks.

12300000 Pharmacology (the study of drugs, i.e. chemical compounds or noninfectious biological substances which may be administered as an aid in the diagnosis, treatment or prevention of disease, for the relief of pain or suffering, or to control or improve any physiological or pathological condition) (See also Normal structure and function, Pathology, Cell biology and CHEMISTRY.)

This broad category would be identified only if the task requires something in the way of knowledge in several of its subdivisions or if knowledge of the field per se were needed (that is, if the study of uses, functions and applications of drugs and pharmaceuticals were needed). It would be unusual in the administering of medications for a task to require categories under Molecular Mechanisms of Drug Action (12310000); they might be needed for prescriptive tasks. A high scale level for Pharmacology is more likely to be found in tasks occurring in the pharmacy, chemist's lab and in experimental work; rarely would it be needed at a high level in prescriptive tasks except for the physician who specializes in the use of drugs or in drug effects.

12331000 # Drug toxicity (Includes antidotal therapy.)

This category covers the adverse effects of drugs due to the nature of the drug.

12332000 # Drug idiosyncrasy and allergy pharmacogenetics (Includes increased sensitivity to drugs, decreased responsiveness to drugs, novel drug effects, etc., which are due to inherited physical characteristics.)

This category covers the adverse effects of drugs due to inherited characteristics of specific individuals, and/or idiosyncratic reactions to drugs and not the toxic nature of the drug.

12335000 # Drug synergism (presence of two or more drugs in the body having interaction effects and the change in drug action this causes.)

This category covers the interaction produced by the presence of two or more drugs in the system and not the effects of the drugs when taken independently.

12337000 # Chemical mutagenesis (drugs which induce mutation, a discontinuous inheritable change in the quality of the offspring, used to inhibit growth of malignant tissues by destroying or modifying the genes)

This category would rarely be required for the usual tasks in patient care, even at the physician's level, unless this specialty area is specifically involved in the elements of the task.

12342600 # Drugs for allergy, cough, vomiting and the dermatomucosal surfaces (Includes anti-immune drugs, antitussives, antiemetics, dermatomucosal agents.)

This category covers the use of drugs to deal with conditions such as allergy, cough, etc., and is found under Drug Classes (12340000); it does not refer to adverse effects of drugs such as allergy, cough, vomiting, etc.

13100000 Physical chemistry

This broad category covers a combined discipline which partakes of the knowledge in Chemistry (13000000) and in Physics (15000000), but which, in combination, amounts to more than the sum of the parts drawn from in the two fields. The categories listed under Physical Chemistry are only those which it was felt could not be listed either under Chemistry or under Physics. However, since the allocation of subdivided categories is rather arbitrary, the reader should make a special effort to investigate categories under Physics and Chemistry as well.

14111000 # Solutions (mechanical, optical, colligative properties; dilute, normal, molar, saturated and supersaturated solutions, whether liquid, solid or gaseous phase) (For analytical tests relying upon one or more of these properties see Chemical analysis and preparation of samples.)

This category may be needed at a low scale level when the task requires knowledge about contrast agents for use in X-ray or fluoroscopy. It will not generally be needed in patient care tasks.

14120000 Chemical analysis and preparation of samples (See also Empirical bonding and structure theories and MATERIALS.)

This category is not intended to cover simple tests such as litmus, dipstick or reagent tablet tests. It refers to the type of analytic procedures which are done in a laboratory; it probably will not be required for primary patient care tasks.

14121000 # Mechanical analysis (tests of mechanical properties of matter) (Includes gravimetrics, weight and specific gravity, strength, hardness, brittleness, ductility; microscopic analysis of physical properties.)

This category may be needed at a low level for testing the specific gravity of urine samples.

14128000 # Separation methods in analysis (Includes selective absorption, distillation and evaporation, extraction by solvents, separation by ion exchange, chromatography and diffusion analysis, precipitation methods.)

This category may be needed at a low level in the preparation of slides for examination under the microscope. It should be identified only if the task requires the performer to apply knowledge such as the staining properties of dyes or stains. Tasks involving set procedures, such as a routine dipstick or tablet test for the presence of sugar in the urine, do not require any knowledge of this category.

20000000 ENGINEERING AND TECHNOLOGY (See also PHYSICS, CHEMISTRY and MATHEMATICS AND RELATED DISCIPLINES.)

Categories under this major division are applications of knowledge in the Natural Sciences (10000000) and in Mathematics and Related Disciplines (50000000). However, the knowledge categories listed under Engineering and Technology are only those which are sufficiently distinctive to warrant individual identification. Knowledge categories under the Natural Sciences and/or Mathematics and Related Disciplines may also be required in addition to categories listed under Engineering and Technology.

36000000 MATERIALS (Includes those aspects of materials related to their application in productive processes.)

This major category is listed under Engineering and Technology. Its subdivisions refer to the characteristics and properties of materials in terms of how they are worked with (or on) in production processes. For example, the properties of Wood are relevant to some of the tasks of the carpenter, the furniture designer, the lumberman, the house painter and the naval architect. These categories should not be overlooked. However, knowledge of items made of different materials that are grouped by use, such as suture materials, are really aspects of other categories, for example, Suture (11735600), rather than of Materials, since the uses of otherwise unrelated materials are involved, rather than the properties of specific materials.

41000000 BEHAVIORAL SCIENCES

The fields of Psychology, Sociology and Anthropology overlap in subject matter and methodology to such a great extent that they are not separately categorized (apart from their histories). These three fields are reflected in Behavioral Sciences according to the subject matter covered. The varying approaches taken in these fields are further reflected in the varieties of "slice" represented in the subdivisions of the various categories.

41670000 # Personality theory (structure and functioning of normal personality) (Includes such personality theories as psychoanalytic, self, field and ego and the ways in which they are synthesized in actual application; determinants of personality.)

This category refers to a knowledge of the various theories that have been offered to explain personality, and would probably not be involved in the type of pragmatic counseling tasks engaged in by nursing personnel.

41710000 Psychotherapy and counseling

This broad category and/or any of its subdivisions can be used only when the task requires some knowledge of these fields as such. Beyond this, the Human Interaction skill scale may more likely be what is needed.

41810000 Culture (Includes cross-cultural comparisons among primitive and modern societies.) (See also HISTORY.)

41814000 # Belief systems (Includes religious, mythological, cosmological and ethical systems.) (See also RELIGION and PHILOSOPHY.)

41817000 # Language as an expression of culture (Includes structural and functional relationship of language to culture.) (See also LINGUISTICS AND LANGUAGES.)

41820000 # Interpersonal (dyadic--two person interaction) processes

41863350 # Special problems of stratification in the United States

These categories may appear to be appropriate for performers who deal with individuals in minority communities. These categories, however, are meant to cover a very different type of knowledge than the kind the performer usually needs in health services tasks. The categories refer to the theories, research and content of such subjects rather than the experiences which they organize as data. When a performer adapts his choice of language and vocabulary to more effectively reach a minority group patient, or is sensitive to problems of discrimination, he is probably using Human Interaction skills which he learns from experience with the people in the community, rather than these categories.

41884000 Social service administration and policy (See also ECONOMICS and POLITICAL SCIENCE when applicable; see also Psychotherapy and counseling.)

This broad category and any or all of its subdivisions may be needed when a task requires the performer to give advice or draw on knowledge about available social services. The category involves the policy and administrative aspects of the services, but also covers knowledge of the availabilities of the services. The specific institution's procedures and means for making referrals are aspects of orientation knowledge and do not warrant scaling, but knowledge of the types of services and the philosophies of their administration is transferable and therefore scalable knowledge.

42300000 # Systems of content presentation (Includes procedures such as lecture, symposium, panel, forum, role-playing, case study, demonstration, colloquium, audio-visual techniques, programmed instruction, micro-labs and laboratory methods.)

42630000 # Professional and graduate education

These two categories may be involved in in-house teaching tasks. They should not be used unless the task requires knowledge of the content covered by these fields as specific disciplines.

51000000 MATHEMATICS

52000000 PROBABILITY AND STATISTICS

Knowledge in these two major disciplines can be required in tasks which also require categories listed under the Natural Sciences (10000000), the Social Sciences (40000000) and Engineering and Technology (20000000). The user should not assume that subject categories found in the Natural and Social Sciences and in Engineering and Technology automatically include the knowledge of categories in Mathematics or Probability and Statistics that may be involved in the tasks unless so stated. However, categories within

Mathematics or Probability and Statistics should be identified only when tasks require more than a rote application of formulas or calculations. Arithmetic is treated under Symbolic Skills and is not identified per se as a knowledge category.

63300000 Literary forms

For this category to be identified the task must require knowledge of, or critical judgment of, the actual literary works indicated by the type of form, or knowledge of the forms for purposes of criticism. This category should not be confused with Writing (65600000) which includes the techniques for creating works in the various literary forms.

65260000 # Photography and cinematography (Includes still and television photography.)

This is a category under The Arts (65000000). It refers to the use of these media for artistic purposes and should not be used as a requirement for the image-producing aspects of X-ray and flouroscopy tasks.

65620000 # Mechanics of writing English (Includes traditional (prescriptive) grammar, punctuation, spelling, bibliographic and footnote form.) (For mechanics of writing other languages see Languages; for the study of grammar see Linguistics.)

English is not identified as a language in the Knowledge System except that Mechanics of Writing English can be identified. Since English is the language of the society, it would appear for every task and would distort the statistical data. In societies where another language is the dominant language, it would be substituted for English in the Mechanics of Writing English, and would not be otherwise identified.

Not every task that involves recording or writing something down on paper requires this category at a non-zero level on the scale. The task must require standards involving knowledge of prescriptive grammar, punctuation, arrangements into paragraphs, etc. Dictation as well as writing by hand or typing would be covered, provided that the requirements scale above zero. Writing or dictating the report of a surgical operation would warrant a scale value of 5.5. The recording of an examination and recommendations on a patient's chart would require a lesser scale value and, if proper English presentation were needed, might scale at 3.5. Scale points 2.5 and 1.5 are usable for tasks which require enough knowledge of Mechanics of Writing English for the information which is recorded to be understandable to the reader through proper presentation.

67000000 LAW (Except where otherwise stated, the following categories refer to the law of the United States.)

The categories found under this broad level discipline should not be identified to cover knowledge of the specific legal regulations which may apply to tasks which require that the performer be licensed before they can be carried out. Any task or job which is limited by regulations requires that the performer know what the law says in regard to his practice, but this kind of knowledge is probably not transferable as knowledge of the categories listed under Law. For example, an anesthetist must know at what stage in a patient's post-operative recovery his legal responsibility for the life of the patient is terminated, but such knowledge cannot be considered to be a building block to higher levels of legal knowledge. The task would have to require legal knowledge of greater applicability or greater breadth of detail to be scalable above zero on the Knowledge Scale.

69100000 Linguistics

69142000 # Grammar and semantics (Includes American structuralist grammar, London school grammar, generative grammar (in its various forms), in their syntactic and semantic aspects.) (For prescriptive grammar (traditional rules of usage) see Writing, Mechanics of writing English; for other languages, see Languages.)

Grammar and semantics refers to the study and use of grammar as a formal subject and is not needed when Mechanics of Writing English (65620000) is identified for tasks involving writing unless the formal subject matter is itself required. Linguistics is identified only when the task requires that the performer know the content of this discipline, as such, in the performance of a task.

69200000 Languages (other than English) (Includes knowledge of oral usage; structure and mechanics of writing the language and traditional grammar, spelling and punctuation.) (For mechanics of writing English see Writing.)

69214200 # Spanish

Under Languages (Other Than English) one finds subdivisions which simply name a large number of languages. If a task requires any language other than English as an intrinsic part of the task, and not due to the particular circumstances of an institution's location, the task must be coded for the required language(s). The category is used for either oral or written use of the language and refers to the structure and mechanics of writing, as well as traditional grammar, spelling, and punctuation.

If, for example, Spanish were needed in the task of translating conversations at an institution, a task requiring only conversational use of Spanish would scale lower than if the task required that the language be taught. In the latter case, the conscious use of grammatical forms would be needed in addition to all the other aspects of usage. Scaling a language identified as a knowledge category differs from scaling the task on any or all of the three language skill scales; the skills deal with precision in the use of language.